The Welding Engineer

Reg. U. S. Pat. Office

Vol. IV | Chicago 608 S. Dearborn St. | OCTOBER, 1919 | $2.00 per year in U. S. $3.00 per year abroad | No. 10

The above photo shows part of the force of a Detroit concern who chose TORCHWELD APPARATUS because their girl operators could produce better welds and more of them, without flashing or other trouble.

One reason why manufacturers prefer TORCHWELD torches, is, that their simplicity and dependability make it possible for comparatively inexperienced welders to produce good welds.

The May 29th issue of the American Machinist contains a very interesting article describing an exceptionally large oxy-acetylene installation. This plant was originally operating with other welding equipment. It is an interesting fact that all the specific welding operations mentioned in the article were made with TORCHWELD torches.

The American manufacturer who enjoys a world-wide reputation for the most efficient shop management has purchased more than 400 TORCHWELD welding and cutting torches.

Figure it out for yourselves; two years ago we were practically unknown—today we are credited with the largest commercial installations of welding and cutting apparatus on record.

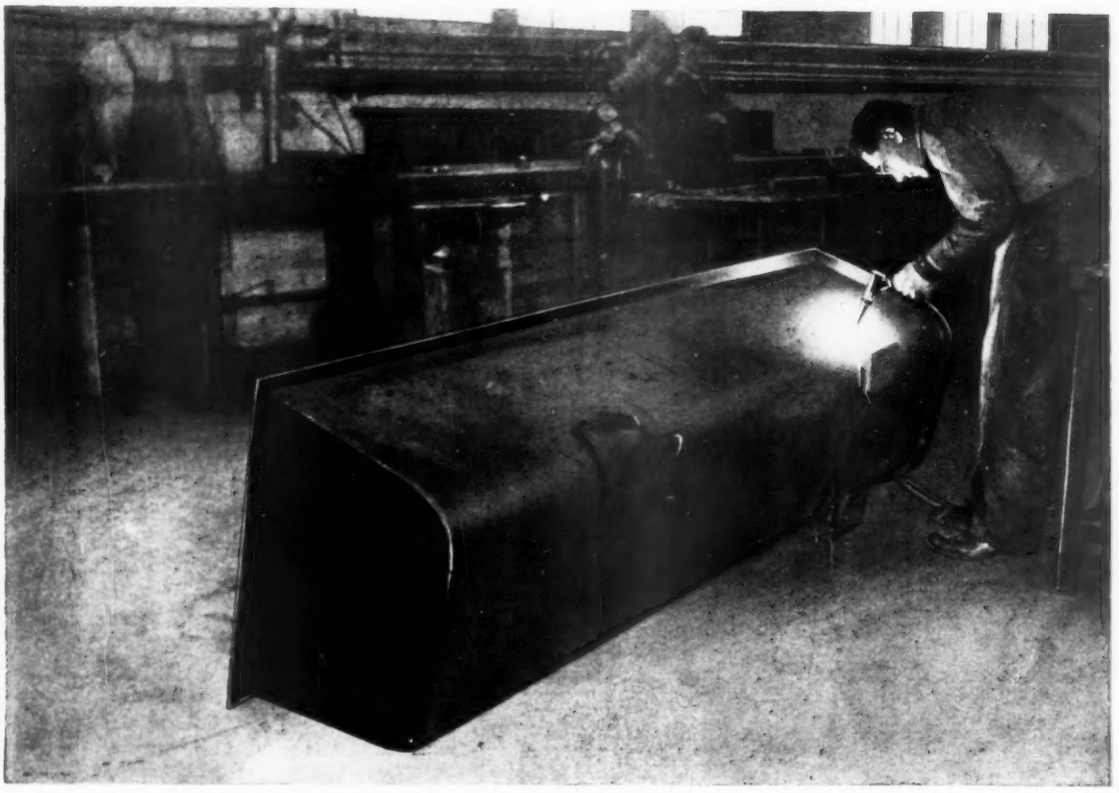
May we send you complete information regarding our proposition?

TORCHWELD EQUIPMENT COMPANY

Fulton and Carpenter Streets CHICAGO

High grade welding and cutting apparatus—portable or generator outfits. Welding materials, fluxes, supplies and accessories.

Pittsburgh
Detroit
New York
Memphis
Cleveland
Minneapolis



The Oxweld Blowpipe is the Best Means for Welding Legs
On Metal Containers of Every Description

ARE YOU USING the oxy-acetylene flame wherever possible in making the metal parts of your product? And are you using Oxweld Apparatus?

Write us about your work.....Learn how others are meeting the problems of your industry—how Oxweld Service is obviating the costlier methods—how you, too, may achieve these improvements and economies by utilizing the Oxweld Injector Type Blowpipe.

OXWELD ACETYLENE COMPANY
NEWARK, N. J. CHICAGO LOS ANGELES
World's Largest Maker of Equipment for
Oxwelding and Cutting Metals

ATTENTION

We Want Several

Active Sales Agents

For Our

HYDREX FLOW INDICATOR

Our instruments are used in numerous first-class welding and cutting shops with most gratifying results.

HYDREX ENGINEERING CORPORATION

Hutchinson Bldg. Buffalo, N. Y.

Hauck No. 7A One-Man Hand Pump Preheater.

$6.00 Against $1.25

The difference is the saving effected through the use of a Hauck No. 7A Kerosene Preheater. Sufficient charcoal for preheating in 8-hour day cost from $6.00 to $8.00. The Hauck No. 7A Preheater did the same work at cost of $1.25 for kerosene.

Furthermore, the Hauck Burner is light, easy to handle and operate. It is a compact and portable form of preheating.

No poisonous gases, no ashes, dirt, etc., when a Hauck Burner is used.

Tell us about your Preheating problem.

Free information about special preheating problems given on request.

HAUCK MANUFACTURING COMPANY

101-113 Eleventh St. Brooklyn, N. Y.

***Quality*—The Best**
***Prices*—Right**
***Delivery*—From Stock**

BIERMAN-EVERETT

WELDING SUPPLIES

have been developed with the growth of the Welding Process, having been on the market since welding was in its infancy, and the constantly increasing demand for these supplies is the best testimonial that can be offered.

PRICES CHEERFULLY QUOTED

Rods Wires Fluxes

BIERMAN-EVERETT FOUNDRY CO.

IRVINGTON, N. J.

K-G SERVICE

1. Apparatus substantially built of the best materials made. Gas and oxygen mixing and consumption guaranteed to be in correct proportions to produce the correct flame and economy.
2. All accessories and supplies of the best quality.
3. The most completely equipped welding shop in New York City and capable of handling the largest castings or any quantity of manufacturers work—men and apparatus supplied for outside work.
4. A large stock of acetylene and Oxygen always on hand to supply our trade at the lowest market prices.
5. Everything needed for oxy-acetylene work we supply.

K-G Welding & Cutting Co.

Incorporated

556 West 34th St., New York City

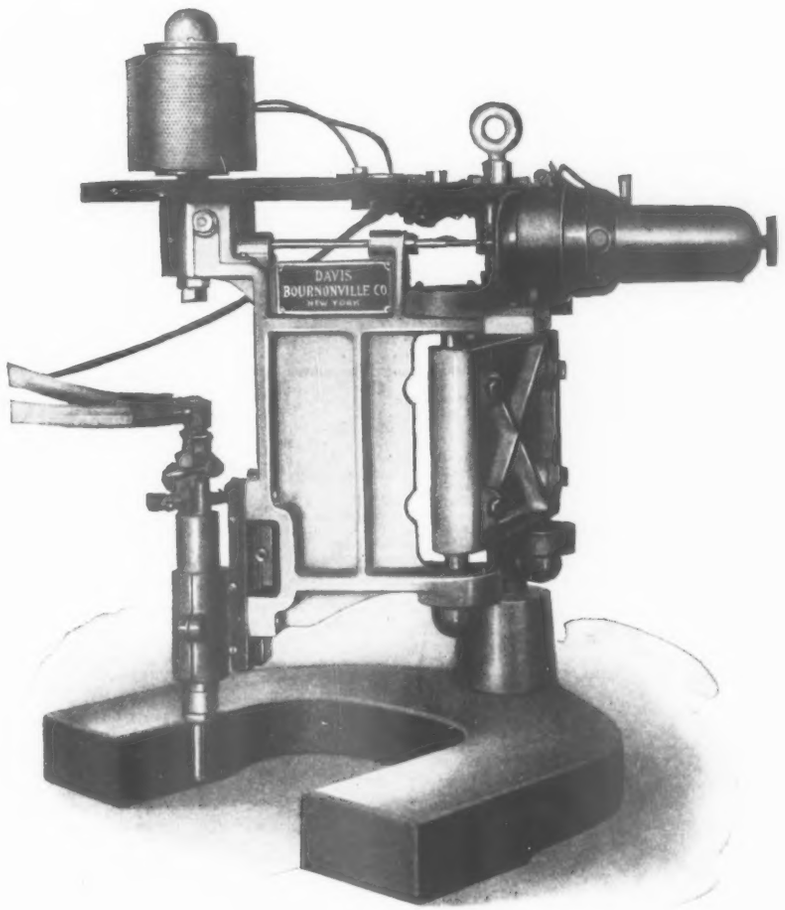
Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.
ACETYLENE (Dissolved)
Linde Air Products Co.
ACETYLENE CYLINDERS
ACETYLENE GENERATORS
Air Reduction Sales Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
ALUMINUM FILLER RODS
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
ALUMINUM FLUX
Alloy Welding Products Co.
American Flux Co.
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Cortland Welding Compound Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Morey Flux & Chemical Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
ALUMINUM SOLDER
Air Reduction Sales Co.
Burdett Oxygen Co.
ANNEALING FURNACES
Buffalo Dental Mfg. Co.
Universal Oxygen Co.
APRONS (Asbestos)
Chicago Eye Shield Co.
F. D. Farnum & Co.
AMMETERS
National Gauge & Eqpt. Co.
ASBESTOS GLOVES
Air Reduction Sales Co.
Burdett Oxygen Co.
Chicago Eye Shield Co.
F. D. Farnum & Co.
F. H. Wheeler Mfg. Co.
ASBESTOS SHEET PAPER
Air Reduction Sales Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
F. D. Farnum & Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
F. H. Wheeler Mfg. Co.
BLOW TORCHES (Acetylene)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Buffalo Dental Mfg. Co.
Federal Brass Works.
Hauck Mfg. Co.
Harris Calorific Co.
Smith's Inventions, Inc.
The Alexander Milburn Co.
Torchweld Equipment Co.
BOOKS (Relating to Welding)
The Welding Engineer
BRASS AND BRONZE FLUX
Air Reduction Sales Co.
American Flux Co.
Burdett Oxygen Co.
Cortland Welding Compound Co.
Hauck Mfg. Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
United States Welding Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Standard Mfg. Co.
Torchweld Equipment Co.
Universal Oxygen Co.
BRASS SPELTER WIRE
Air Reduction Sales Co.
Burdett Oxygen Co.
Universal Oxygen Co.
Torchweld Equipment Co.
BRAZING OUTFITS
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
BRONZE FILLER RODS
Air Reduction Sales Co.
Burdett Oxygen Co.
Hauck Mfg. Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
CARBIDE (Calcium)
Canada Carbide Sales Co.
Union Carbide Sales Co.
CARBON (Blocks, Paste, Etc.)
National Carbon Co.
CARBON REMOVING TORCHES
Air Reduction Sales Co.
The Bastian-Blessing Co.
Burdett Oxygen Co.
Bermo Supply Co.
Davis-Bournonville Co.
Federal Brass Works.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Mach. Co.
Torchweld Equipment Co.
Universal Oxygen Co.
CAST IRON FILLER RODS AND FLUX
American Flux Co.
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
Cortland Welding Compound Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Standard Mfg. Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
COPPER FLUX
American Flux Co.
CYLINDERS
Wm. Wharton, Jr., & Co.
ELECTRIC ARC WELDING OUTFITS
Electric Arc Welding & Cutting Co.
Gibb Instrument Co.
Lincoln Elec. Co.
National Elec. Co.
Westinghouse Elec. & Mfg. Co.
ELECTROLYTIC CELLS
Burdett Oxygen Co.
International Oxygen Co.
The Electrolabs Co.
Universal Oxygen Co.
ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
Air Reduction Sales Co.
Burdett Oxygen Co.
The Electrolabs Co.
International Oxygen Co.
Universal Oxygen Co.
FILLER RODS (Aluminum)
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Hauck Mfg. Co.
International Oxygen Co.
Torchweld Equipment Co.
United States Welding Co.
FILLER RODS (Swedish Iron)
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Bermo Supply Co.
Davis-Bournonville Co.
Federal Tool & Alloy Steel Corp.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
FILLER RODS (Tobin Bronze)
Air Reduction Sales Co.
Burdett Oxygen Co.
Bermo Supply Co.
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
FILLER RODS (Vanadium Steel)
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
FIREPROOF PLASTIC
Bermo Supply Co.
FLUE WELDERS (Electric)
FLUXES
American Flux Co.
Cortland Welding Compound Co.
Anti-Borax Compound Co.
FURNACES (Annealing)
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Universal Oxygen Co.
GASOLINE PREHEATING FURNACES
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Superior Oxy-Acetylene Machine Co.
GAS BURNERS (Preheating)
Air Reduction Sales Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
GAS FLOW INDICATORS
Hanau Engineering Co.
GAUGES
National Gauge & Equipment Co.
U. S. Gauge Co.
GENERATORS (Oxygen or Hydrogen)
Burdett Oxygen Co.
The Electrolabs Co.
International Oxygen Co.
Universal Oxygen Co.
GLOVES (Welders Asbestos)
Burdett Oxygen Co.
Davis-Bournonville Co.
International Oxygen Co.
Torchweld Equipment Co.
F. D. Farnum & Co.
F. H. Wheeler Mfg. Co.
GOGGLES
Chicago Eye Shield Co.
The Alexander Milburn Co.
GRINDING MACHINES
HARDENING FURNACES
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
HOSE (Oxygen and Acetylene)
Air Reduction Sales Co.
Burdett Oxygen Co.
Bermo Supply Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
International Oxygen Co.
Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
HOISTING MACHINERY
HOSE UNIONS
Air Reduction Sales Co.
Bermo Supply Co.
K-G Welding & Cutting Co.
Hauck Mfg. Co.
International Oxygen Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
HYDROGEN GENERATING APPARATUS
Air Reduction Sales Co.
Burdett Oxygen Co.
Electrolytic Oxy-Hydrogen Laboratories, Inc.
International Oxygen Co.
Universal Oxygen Co.

DAVIS-BOURNONVILLE

CAMOGRAPH NO. 2



A new boiler shop and fabricating plant machine that automatically cuts hand holes and other openings in boiler sheets, ship plates, tanks, drums and pressure containers with oxy-acetylene has been added to the D-B line of mechanically-operated cutting torches.

Send for descriptive bulletin Form 497.

DAVIS-BOURNONVILLE COMPANY

General Offices, Jersey City, N. J.

Factories: Jersey City, N. J., Elkhart, Ind., and Niagara Falls, Ontario

Atlanta	Chicago	Detroit	Montreal	St. Louis
Boston	Cincinnati	Los Angeles	New York	San Francisco
Buffalo	Cleveland	Manila	Philadelphia	Seattle
Callao	Dallas	Minneapolis	Pittsburgh	Toronto

HYDROGEN PLANTS
Burdett Oxygen Co.
Electrolytic Oxy-Hydrogen Laboratories, Inc.
International Oxygen Co.
KEROSENE PREHEATING TORCHES
Air Reduction Sales Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
NEEDLE VALVES
Air Reduction Sales Co.
Burdett Oxygen Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Buffalo Dental Mfg. Co.
Federal Brass Works.
General Welding & Eqpt. Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
NICKEL FLUX
American Flux Co.
NITROGEN
Linde Air Products Co.
OIL BURNERS (Preheating)
Air Reduction Sales Co.
Gas Products Assn.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co.
OXY-ACETYLENE PROCESS
Linde Air Products Co.
OXYGEN (Compressed in Cylinders)
Air Reduction Sales Co.
Burdett Oxygen Co.
Gas Products Ass'n.
International Oxygen Co.
The Linde Air Products Co.
Swift & Co.
Universal Oxygen Co.
OXYGEN AND HYDROGEN GENERATING EQUIPMENT
Burdett Oxygen Co.
The Electrolabs Co.
Gas Products Assn.
International Oxygen Co.
Universal Oxygen Co.
OXYGEN CYLINDERS
PIPE WELDING
Metal & Thermit Corp.
PHOTOGRAPHS
Chicago Architectural Photographing Co., (Specialists in photographs relating to the welding industry)
PLASTIC (Fireproof)
PRESSURE GAUGES
Air Reduction Sales Co.
Bastian & Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Hauck Mfg. Co.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
National Gauge & Eq'p't Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
U. S. Gauge Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
REGULATING VALVES (Acetylene)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Hauck Mfg. Co.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
Universal Regulator Co.
REGULATING VALVES (Hydrogen)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Burdett Oxygen Co.
Bermo Supply Co.
Federal Brass Works.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
REGULATING VALVES (Hydrogen) Cont.
Universal Regulator Co.
Harris Calorific Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
Universal Oxygen Co.
REGULATING VALVES (Oxygen)
The Bastian-Blessing Co.
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Federal Brass Works.
Harris Calorific Co.
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
Universal Regulator Co.
SCHOOLS OF WELDING
SCORED CYLINDERS
L. Lawrence & Co.
SEAM WELDERS (Electric)
General Electric Co.
TANK CONNECTIONS (Oxygen and Acetylene Adaptors)
International Oxygen Co.
Superior Oxy-Acetylene Machine Co.
The Imperial Brass Mfg. Co.
Torchweld Equipment Co.
THERMALENE-GAS
The Thermalene Co.
THERMIT WELDING
Metal & Thermit Corp.
TORCHES (Gasoline and Kerosene Preheating)
Air Reduction Sales Co.
Buffalo Dental Mfg. Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Westinghouse Electric & Mfg. Co.
TORCHES (Oxy-Acetylene Cutting)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
TORCHES (Oxy-Acetylene Welding)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
TORCHES (Oxy-Hydrogen Cutting)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Harris Calorific Co.
TORCHES (Oxy-Hydrogen Cutting) Cont.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Harris Calorific Co.
International Oxygen Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
The Alexander Milburn Co.
The Imperial Brass Mfg. Co.
Torchweld Equipment Co.
Oxweld Acetylene Co.
TORCHES (Oxy-Hydrogen Welding)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
Federal Brass Works.
Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
TRUCKS (Cylinder Carriers)
Air Reduction Sales Co.
Davis-Burnonville Co.
The Imperial Brass Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
The Bastian-Blessing Co.
Air Reduction Sales Co.
Burdett Oxygen Co.
VALVES (For Oxygen Cylinders)
International Oxygen Co.
Universal Oxygen Co.
WELDING APPARATUS
See also "Torches:"
WELDING APPARATUS (Plastic Arc)
Wilson Welder & Metals Co.
Wilson Welder & Metals Co.
WELDING APPARATUS (Electric)
Electric Arc Welding & Cutting Co.
General Electric Co.
Gibb Instrument Co.
Lincoln Elec. Co.
National Electric Co.
Westinghouse Elec. Mfg. Co.
WELDERS' GLOVES
Chicago Eye Shield Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
F. H. Wheeler Mfg. Co.
WELDERS' GOGGLES
Air Reduction Sales Co.
Burdett Oxygen Co.
The Imperial Brass Mfg. Co.
Chicago Eye Shield Co.
International Oxygen Co.
Torchweld Equipment Co.
WELDING METALS (Certified)
Wilson Welder & Metals Co.
WELDING (Oxygen for)
The Linde Air Products Co.
Air Reduction Sales Co.
Burdett Oxygen Co.
International Oxygen Co.
Universal Oxygen Co.
WELDING RODS AND WIRE
Atlas Foundry Co.
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
The Imperial Brass Mfg. Co.
Federal Tool & Alloy Steel Corp.
International Oxygen Co.
Oxweld Acetylene Co.
Page Steel & Wire Co.
Torchweld Equipment Co.

ALPHABETICAL INDEX TO ADVERTISERS

A
Air Reduction Sales Co. 59
Anti-Borax Compound Co. 16
American Flux Co. 51
Alloy Products Co. 66
Atlas Foundry Co. 66

B
Bastian-Blessing Co., The 34-35
Bermo Supply Co. 66
Bierman-Everett Fdy. Co. 3
Buffalo Dental Mfg. Co. 9
Burdett Oxygen Co. 18

C
Canada Carbide Sales Co. 14
Central Steel & Wire Co. .....
Chicago Eye Shield Co. 57
Commercial Acetylene Supply Co. ..Back Cover
Cortland Welding Compound Co. 15

D
Davis-Bournonville Co. 5-16-27

E
The Electrolabs Co. 9
Electric Arc Welding & Cutting Co. 37

F
F. D. Farnum & Co. 65
Federal Brass Works. 11
Federal Tool & Alloy Steel Corp. 61

G
General Electric Co. 10
General Welding & Equipment Co. 57
Gas Products Assn. 47
Gibb Instrument Co. 45
M. C. Green 27

H
Harris Calorific Co. 19
Hydrex Engineering Co. 3
Hauck Mfg. Co. 3

I
Imperial Brass Mfg. Co. 27-53
International Oxygen Co. 65

K
K-G Welding & Cutting Co. 3
Julius King Optical Co. 33

L
Linde Air Products Co. 20
Lincoln Electric Co. 39
L. Lawence & Co. 29

M
Metal & Thermit Corp. 17
The Alexander Milburn Co. 43
Morey Flux & Chemical Co. 66
Modern Engineering Co. 61

N
National Carbon Co. 66
National Gauge Eqpt. Co. 61-66
National Electric Co. 58

O
Oxweld Acetylene Co. 2

P
Page Steel & Wire Co. .....
Portland Brazing Machine Works. .....
The Prest-O-Lite Co., Inc. 12

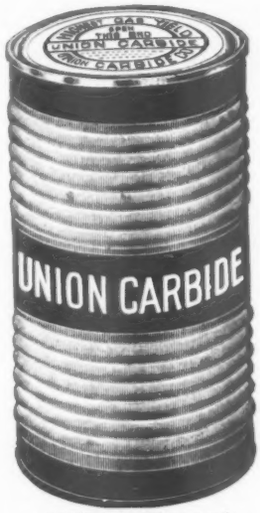
R
Rochester Welding Works. .....

S
Smith's Inventions, Inc. .....
Superior Oxy-Acetylene Machine Co. .....
Sorenson, C. .....
Southern Welding Mach. Co. .....
Swift & Co. .....
Standard Mfg. Co. .....

T
The Thermalene Co. .....
Torchweld Equipment Co. .....

U
Union Carbide Sales Co. .....
U. S. Gauge Co. .....
United States Welding Co. .....
Universal Oxygen Co. .....
Universal Regulator Co. .....

W
Welders Supply Shop. .....
Westinghouse Elec. Mfg. Co. .....
Wilson Welder & Metal Co., Inc. .....
F. H. Wheeler Mfg. Co. .....
Wm. Wharton, Jr., & Co., Inc. .....



Packed in Blue and Gray Drums

Union Carbide Sales Company

New York City, 42nd St. Building — **Chicago, Ill., Peoples Gas Building** — **San Francisco, Cal., Kohl Building**

SOLE DISTRIBUTORS OF

UNION CARBIDE

"World's Best Quality—Highest Gas Yield"

For Oxy-Acetylene Welding Plants

Contractors' Flare Lights, Torches and Private and Municipal Lighting Plants

"Union Carbide" is packed in 100-lb. blue and gray drums marked conspicuously, "UNION CARBIDE."

The following sizes are carried in stock in 100-lb. drums:

$3\frac{1}{2}$ x 2 in. —a large size.

$1\frac{1}{4}$ x $\frac{3}{8}$ in. —an intermediate size.

2 x $\frac{1}{2}$ in. —a medium size.

$\frac{1}{4}$ x 1/12 in. —finely crushed size.

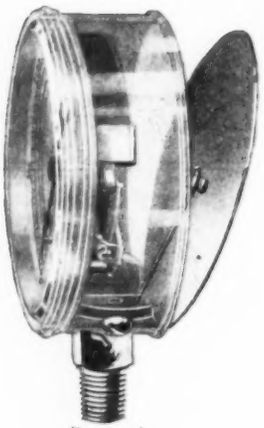
Union Carbide in the Generator sizes above listed will be shipped direct to consumers from a **Union Carbide Sales Co.** warehouse at any one of the following points where large stocks are kept on hand:

ALABAMA
Birmingham—1916 Morris Ave.
Mobile—16 S. Commerce St.
Montgomery—114 N. Perry St.
ARIZONA
Phoenix—42 S. Central Ave.
ARKANSAS
Fort Smith—109-123 So. Ninth St.
CALIFORNIA
Fresno—932 H St.
Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.
COLORADO
Denver—Nineteenth and Wazee Sts.
CONNECTICUT
Hartford—412 Trumbull St.
DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.
FLORIDA
Jacksonville—515 W. Bay St.
Tampa—107 Madison St.
GEORGIA
Atlanta—Cor. Haynes and Rhodes Sts., P. O. Box 1594.
Savannah—Ogeechee Canal, South of Bay St., P. O. Box 78.
ILLINOIS
Chicago—Peoples Gas Bldg., Michigan Blvd.
Decatur—133-147 W. Williams St.
East St. Louis—600 Walnut Ave.
Peoria—100-110 Edmund St.
Monmouth—124 E. Archer Ave.
Marion—315 S. Granite St., Box 747.
Quincy—222 S. Eighth St.
Streator—702 East Elm St.
INDIANA
Evansville—1601 Illinois St.
Fort Wayne—2216 Broadway.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.
IOWA
Davenport—118 Harrison St.
Des Moines—3rd and Elm Sts.
Dubuque—8th and Washington Sts.
Fort Dodge—10 S. 8th St.
Ottumwa—207-9-11 S. Washington St.
Sioux City—925 Fourth St., P. O. Box 398.
Waterloo—1209 E. 4th St.
KANSAS
Pittsburg—109 W. Third St.
Salina—154 So. 5th St.
Wichita—535-543 West Douglas Ave.
KENTUCKY
Louisville—126 E. Main St.
Middlesboro—1701 Cumberland Ave.
LOUISIANA
New Orleans—819-21 Julia St.
MAINE
Portland—11 Exchange St.
MARYLAND
Baltimore—19 E. Lombard St.
Cumberland—1 N. Liberty St.
Salisbury—Opp. Fulton Station.
MASSACHUSETTS
Boston—(See Cambridge "A.")
Cambridge—241 Albany St.
Springfield—Napier St.
MICHIGAN
Detroit—Grand River and Lorain Ave.
Grand Rapids—500 Shawmut Ave., N. W.
Hancock—First National Bank Bldg.
Iron Mountain—215 E. A St.
Jackson—172 South Water St.
Muskegon—43 No. Terrace St.
Saginaw—1830 No. Michigan Ave.
Sault Ste. Marie.
MINNESOTA
Minneapolis—334 N. First St.
Virginia—413 Chestnut St.
MISSISSIPPI
Vicksburg—1312 Washington St.
MISSOURI
Kansas City—1316-1318 W. Eighth St.
St. Joseph—920 S. Sixth St., Sta. "A."
St. Louis—(See East St. Louis, Ill.)
NEBRASKA
Omaha—1007-9-11 Jones St., Union Sta. P. O.
NEW JERSEY
Camden—West and Clinton Sts.
Jersey City—554-56 Henderson St.
NEW YORK
Albany—Montgomery and Colonie Sts.
Binghamton—21 Jarvis St.
Buffalo—1336 Genesee St.
Geneva—Exchange St. and Railroad Pl.
Hurleyville.
Jamaica—11 New York Ave.
Kingston—O'Neil St., near Broadway.
New York.
Niagara Falls.
Poughkeepsie—Smith St. and N. Y., N. H. & H. R. R. Tracks.
Utica—135 Hotel St.
Watertown—438 Court St.
Whitehall—22 Main St.
NORTH CAROLINA
Charlotte—Post Office Box 777.
Raleigh—107 Fayetteville St.
Wilmington—Room 16 Masonic Temple, 13 N. Front St.
NORTH DAKOTA
Fargo—17 Broadway.
OHIO
Canton—400 Walnut Ave. S. E.
Cincinnati—67 Plum St.
Cleveland—601 The Citizens' Building.
Columbus—330 Dublin Ave.
Dayton—812-828 E. First St.
Lima—338 East High St.
Mansfield—40 West Third St.
Steubenville—324-343 North 7th St.
Toledo—414 S. Erie St.
Zanesville—Main and Second Sts.
OKLAHOMA
Oklahoma City—27-29 E. Grand Ave.
Tulsa—1—11 No. Boulder St.
OREGON
Portland—Fifteenth and Hoyt Sts.
PENNSYLVANIA
Beaver—359 Beaver St.
Du Bois—Webber Ave. and Franklin St.
Erie—1426 Chestnut St.
E. Greensburg—Clark and George St.
Harrisburg—627 Walnut St.
Johnstown—Messenger St. & B. & O. R. R.
Pittsburgh—1202 Chamber of Commerce Building.
Pottsville—Railroad and Sanderson Sts.
Scranton—Penn Ave. and Vine St.
Shamokin—5th and Walnut Sts.
Williamsport—Canal and Court Sts.
SOUTH CAROLINA
Charleston—No. 3 Liberty St.
TENNESSEE
Chattanooga—627 Volunteer State Ins. Bldg.
Knoxville—426 West Depot Ave.
Memphis—671 South Main St.
Nashville—105-107-109 Broadway.
TEXAS
Dallas—802-810 Cadiz St.
El Paso—900 E. Overland St.
Houston—Baker and Cedar Sts., Box 745.
San Antonio—Cor. Leal and N. Salado Sts.
Waco—13th and Mary Sts.
UTAH
Salt Lake City—118 W. Second South St.
VIRGINIA
Lynchburg—1324 Commerce St.
Norfolk—513 Front St.
Richmond—18th and Cary Sts.
WEST VIRGINIA
Bluefield—195 Roanoke St.
Charleston—Broad St. and K. & M. R. R.
Fairmont—"A" Street.
Huntington—820 3rd Avenue.
WASHINGTON
Seattle—1103 First Ave.
Spokane—646 Peyton Building.
WISCONSIN
La Crosse—Front and King Streets.
Madison—613-19 Williamson Street.
Milwaukee—120-134 Jefferson St.

We recommend our customers to select from the list, the city from which the quickest delivery and lowest freight rate can be obtained, **and address their orders to "Union Carbide Sales Company"** at the distributing point selected **accompanied by remittance.**

Please address request for information or special correspondence to either the New York or Chicago office.

No Other Oxy-Welding Gauge Has Them



Patented

The Solid Cast front behind the dial, and pressure relieving back—both essential for absolute safety—are typical of the U. S. Oxy-Welding Gauges only.

But these aren't the only reasons why approximately 90% of the trade insist upon them.

Catalogue W W goes into full details. May we send it to you?

U.S. GAUGE CO. N.Y.

United States Gauge Co.

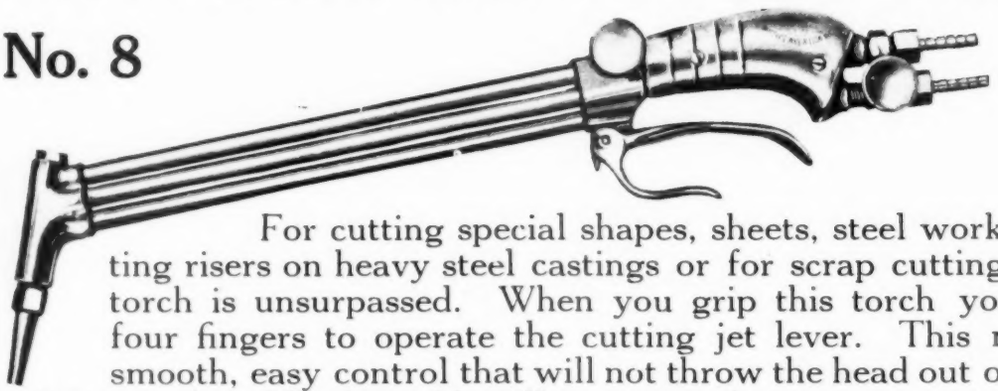
67 Wall Street, New York

Chicago Boston Detroit Philadelphia New Orleans San Francisco Montreal

U.S. GAUGE CO. N.Y.

SMITH'S PISTOL GRIP CUTTING TORCH

No. 8



For cutting special shapes, sheets, steel work, cutting risers on heavy steel castings or for scrap cutting, thi torch is unsurpassed. When you grip this torch you use four fingers to operate the cutting jet lever. This means smooth, easy control that will not throw the head out of line. Convenient, comfortably shaped handle prevents fatigue.

No. 8. Smith's Pistol Grip Cutting Torch furnished with one cutting tip.

Extra copper cutting tips cutting up to 1, 3, 6 and 24 inches. Sizes 1 to 4, 2½ inches long.

Guaranteed

Try it ten days in your shop. If not entirely satisfactory return to us or the jobber or dealer from whom you bought it and your money will be refunded.

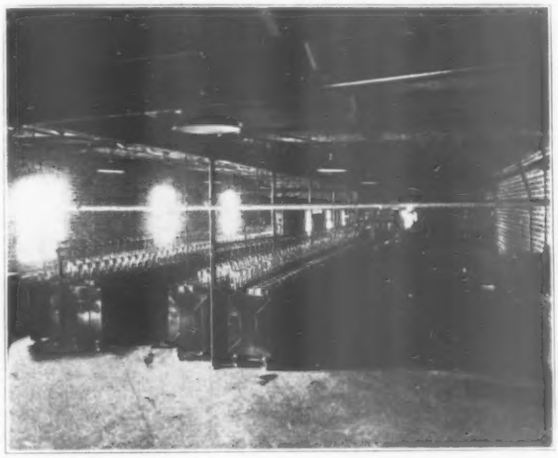
Users of several Smith's cutting torches write for special offer. Complete catalog on request.

SMITH'S INVENTIONS, Inc. *Dept. 1* **Minneapolis, Minn.**

The Heart of Your Welding Business

The efficiency of your welding plant is always dependent upon a constant and sure supply of Oxygen. You can not afford to hold up important work because of a shortage of gas.

Electrolabs apparatus assures a **constant** and **sure** supply of **pure** Oxygen and Hydrogen for cutting and welding. Both gases cost less than half the cost of Oxygen in Cylinders.



A 200-cell "Electrolabs" installation for the Bettendorf Oxygen Co.

Electrolabs Plants are in successful operation all over this Continent, both large and small installations. There is an **Electrolabs** Plant of just the capacity you need.

Consult with us about your needs. We are glad to furnish information to welders.

The Electrolabs Company

15 Williams St., New York, N. Y.

General Office and Works:
2635 Penn Avenue,
Pittsburgh, Pa.

Under the Technical Supervision of the Electrolytic Oxy-Hydrogen Laboratories, Inc.

Electrolabs
ELECTROLYTIC GAS SPECIALISTS

Morris Bldg.,
Philadelphia, Pa.

Merchants' Exch. Bldg.,
San Francisco, Calif.

Manufacturers of

SEAMLESS STEEL CYLINDERS

For:

Oxygen
Hydrogen
Blaugas
Butane

Interstate Commerce Commission Specifications

RIGHT PRICES—PROMPT DELIVERIES—SUPERIOR SERVICE

Wm. Wharton Jr. & Co., Inc.

[Founded 1859]

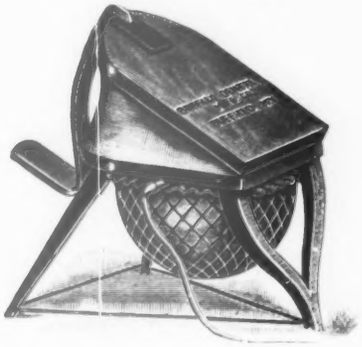
Gas Cylinder General Sales Offices:
30 Church St., New York City

DISTRICT OFFICES:

Boston, New York, Chicago, Philadelphia, Scranton, Pittsburgh, Cleveland, San Francisco

Foot Blowers

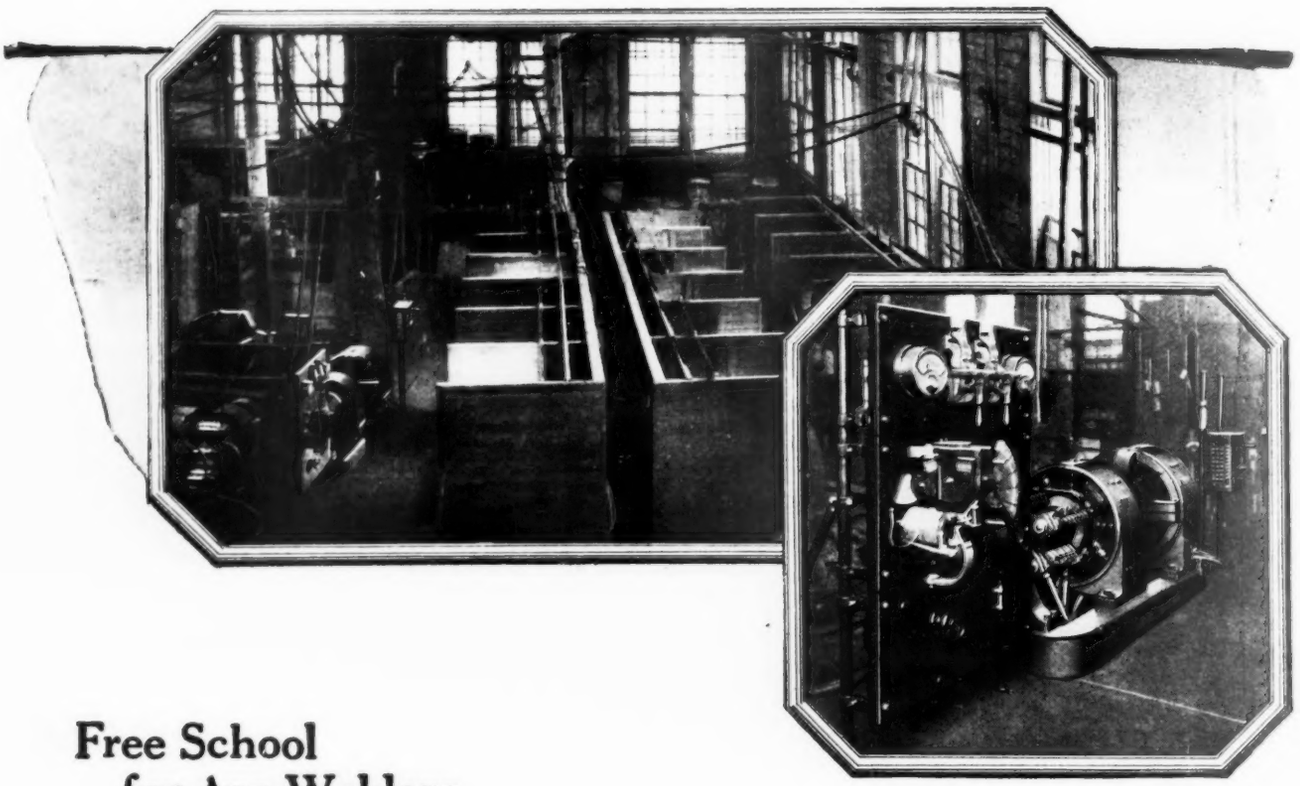
No. 10 FOOT BLOWER, $8.00



For a simple, compact, portable arrangement to give a steady blast of air for blowpipe work or for any other operation requiring positive pressure air blast, we manufacture two styles and three sizes of foot blowers, ranging in capacities from three to ten cubic feet per minute. Our catalogue "B. X." free for the asking, gives full description and prices. **Interested?**

Buffalo Dental Manufacturing Co.,
Buffalo, N. Y., U. S. A.

Specialized industrial training eliminates mistakes that are costly in time and material.



Free School for Arc Welders

THE above illustration shows two views taken in the General Electric Company arc welding school at Schenectady, where courses are given in the following work:

Course 1: Repairs to steel castings.

Course 2: Repairs to iron castings.

Course 3: Repairs to steel plates and tanks.

Course 4: Recovery of broken taps and drills from castings.

Course 5: Welding of high-speed steel to low-carbon steel.

Course 6: Welding and cutting by carbon arc.

In from six to eight weeks men who have had no arc welding experience become efficient welders at the General Electric Company school in Schenectady.

Each student's record is kept and will be mailed on request to employer sending him to school.

This training is necessary as, unless operator holds a steady arc of uniform length, "cold welds" will be formed which will readily break open when subjected to a strain.

Dozens of prominent firms and departments of the U. S. Government availed themselves of the opportunity to have their men receive this exceptional training.

Instruction is free of charge to employees of those purchasing G-E arc welding equipment.

Send for Bulletin No. 48953 on Our Arc Welding School

43-254

General Electric Company

General Office Schenectady, N.Y.

Master Welders

Use

"Federal" Regulators

For Oxygen, Acetylene and Hydrogen Gases

Here's the Reason Why:

"FEDERAL" Regulators are made of the very best materials by expert mechanics for expert welders who know the value of and appreciate absolutely dependable Regulators.

They are passed by the National Board of Underwriters and their safety features make accidents to operators practically impossible.

FEDERAL BRASS WORKS

31st St. and Kedzie Ave. CHICAGO

Swift's Pure Oxygen

"A Reputation Imposes an Obligation"

Swift Oxygen must pass the most rigid tests —must never vary from its high quality standard.

Swift Oxygen is produced in the largest electrolytic plant in the U. S. A.—in ample quantities to render unequalled service to our customers.

The use of Swift Oxygen in your plant will aid you in raising the standard of the work of your operators.

The Name is Your Guarantee

Swift & Company,

Oxygen Department

Union Stock Yards Chicago, Ill.

We will help you train an efficient welding force

When you bought that welding set, had you any previous welding experience?

Was the success of the venture left to half-trained operators?

If so, you have not realized the full value of electric welding as a money saving investment.

THE SECRET OF SUCCESS IS TRAINED MEN

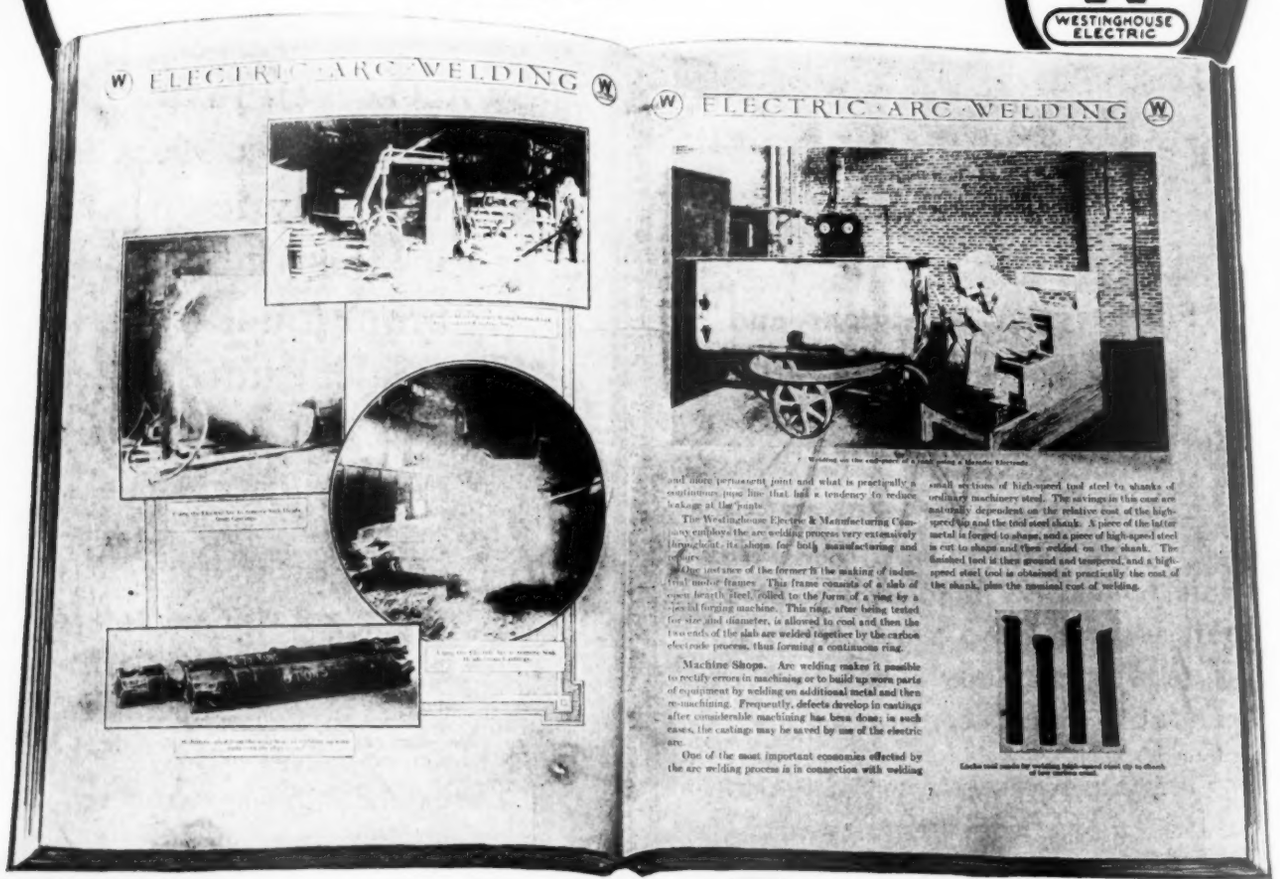
Pick out a promising man and send him to our Welding School. Let us train this man so he will be able to instruct others and direct their work. Send him back a year later, if you wish, for further instructions, for new things are rapidly developing in the welding art.

There is no charge for this instruction. Every new man you add to your force, should spend some time in our school.

Ask for a copy of our new 50-page Catalog on Electric Arc Welding.

Westinghouse Electric & Manufacturing Co.,
East Pittsburgh, Pa.

W WESTINGHOUSE ELECTRIC

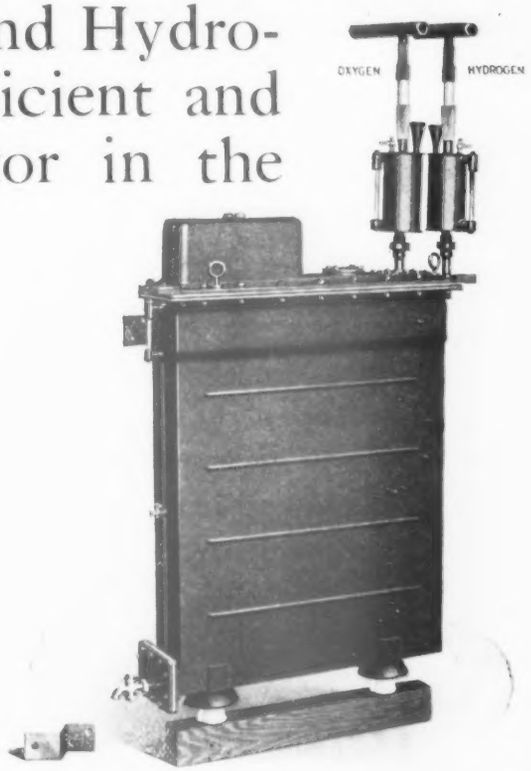


Westinghouse

Investigate This Generator

The "UNIVERSAL" Generator for producing Oxygen and Hydrogen is the most efficient and economical Generator in the market.

It is fool-proof, easy to operate and absolutely dependable. Oxygen generated by the "Universal" Generator is cheaper and better, and your Hydrogen costs nothing.



ELECTROLYTIC OXYGEN & HYDROGEN CELL MODEL C

"Universal" Generators are made in a number of sizes to fit every requirement. Tell us about your needs and we will tell you all about that particular size "Universal" Generator you need in your shop. Write today.

Manufactured by

Universal Oxygen Company

Sheboygan - - - - - Wisconsin

Sky high in QUALITY

CANADIAN CARBIDE

"More Gas per Pound"

CARBIDE SIZES

Medium	3½" x 2"
Small	2" x ½"
Nut	1¼" x ⅜"
Pea	¼" x ½"
Miners' Special	½" x ½"

Packed in

1000 lb - 100lb
and 25lb *Drums*
10 lb 5lb 2lb 1 lb.
Tins

ALABAMA
Bessemer, 2014-2024 Second Ave.
CALIFORNIA
Oakland, see San Francisco.
San Francisco, 427 Rialto Bldg.
ILLINOIS
Belleville, Martha & Clemens Aves.
Benton.
Chicago, 549 McCormick Bldg.
Springfield, 812-814 E. Adams St.
INDIANA
Clinton.
Rochester.
Terre Haute, 15 N. Eighth St.
IOWA
Albia.
Centerville.
Knoxville.
KENTUCKY
Beaver Creek.
LOUISIANA
New Orleans.
MARYLAND
Baltimore, 15 E. Lombard St.
Emitsburg.
Westernport.
MASSACHUSETTS
Boston, 47 Oliver St.
MICHIGAN
Detroit, 343 Bellevue Ave.
Saginaw, Thompson & Franklin Sts.
MINNESOTA
Duluth, Third Ave. E. & Michigan St.
MISSOURI
Joplin, opposite Postoffice.
Lexington.
NEW JERSEY
Paterson, 61-63 Washington St.
NEW YORK
Buffalo, Seneca & Hamburg Sts.
Cortlandt, 41 Elm St.
Malone, 32-34 W. Main St.
Middletown, 28 W. Main St.
New York City, 30 Church St.
Roscoe.
Springville.
Trumansburg, 55 Main St.
Valley Stream.
OHIO
Barton.
Canton, 1372 Dueber Ave.
Cleveland, 3300 Lakeside Ave.
Crescent.
Dillonvale.
Maynard.
Nelsonville.
Salem.
Toledo, 928 George St.
OKLAHOMA
Commerce.
Tulsa.
PENNSYLVANIA
Avonmore.
Barnesboro.
Clymer.
Hastings.
Latrobe.
Nanty Glo.
Pittsburgh, 1222 Farmers Bank Bldg.
Portage.
Pottsville, Center & Market Sts.
Saltsburg.
Scranton.
South Dork.
Wilkesbarre.
Wilpen.
RHODE ISLAND
Providence, 546 Charles St.
TENNESSEE
Knoxville, 761 Asylum Ave.
TEXAS
El Paso, 323 S. Santa Fe St.
UTAH
Salt Lake City, 121 W. 2nd South St.
VERMONT
Burlington, Park Ave.
VIRGINIA
Onacock.
Richmond, 1319 E. Main St.
WEST VIRGINIA
Bluefield, 209-206 Railroad Ave.
Charleston, 821 Virginia St.
Clarksburg, 603 Goff Bldg.
Huntington, 1023 Third Ave.
Matewan.
Morgantown.
Northfork.

CANADA CARBIDE SALES CO.,
INCORPORATED
WORKS
30 CHURCH ST. NEW YORK — SHAWINIGAN FALLS, QUEBEC — 549 McCORMICK BLDG. CHICAGO

We Can Save You Money

ON

GAS AND OXYGEN

USE

WELD-A-CAST
Trade Mark

FLUXES

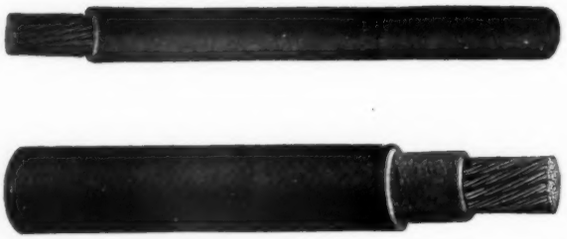
"Weld-a-cast" is a scientific combination of chemicals, that causes the metal to melt rapidly, shortening the operation, thus economizing in time, gas and oxygen.

"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

Write For Free Samples

CORTLAND WELDING COMPOUND CO.
CORTLAND, N. Y.

Extra Flexible Cable



Have you had difficulty in getting a good, flexible cable—one that will not soak through—one that will stand up for years?

We have developed a cable that has proved itself. It has all your requirements.

We can deliver it to you NOW—NO WAITING.
We have the ordinary flexible cable in stock at all times.
We will send you a sample if you want to examine it, or we will take your order for any length.

Electric Arc Cutting and Welding Co.

222 Halsey Street **Newark, N. J.**

Fluxes That Flux

Aluminum Welding
is difficult, in many cases impossible, without the aid of the correct flux.

Deebee Aluminum Powder
for Cast and Plate Aluminum and

Napolitan Flux
for Sheet Aluminum

Have been developed and are manufactured in the Davis-Bournonville laboratories.

These fluxes immediately dissolve the aluminum oxide, permitting the metal to unite, and contain no chemicals that will injure the weld.

Write for sample

WELDING AND CUTTING
DAVIS
APPARATUS
DAVIS-BOURNONVILLE CO. N.Y.

Davis-Bournonville Company
General Office and Factory
Jersey City, N. J.

Anti-Borax Welding Fluxes

It Pays to Use Only the Best

Better and stronger welds are more easily and more quickly made with Anti-Borax Welding Fluxes. That's real economy.

For Cast Iron, Brass, Bronze, Malleable Iron, Steel, Cast and Sheet Aluminum.

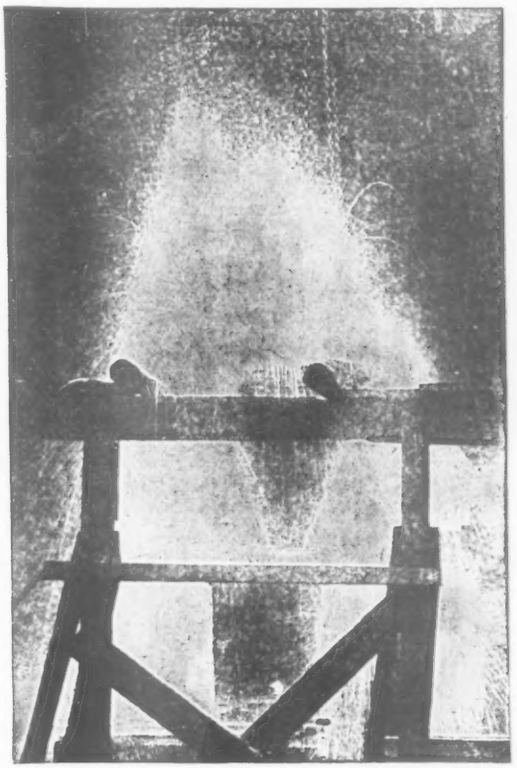
Anti-Borax Fluxes are scientific preparations which weld at lower heat, leave no scale, cleanse the molten metal, assist fusion and improve the quality of your work.

Anti-Borax Fluxes are the best that money can buy, yet they cost no more—usually less than inferior brands.

Guaranteed to give perfect satisfaction or your money refunded.

WRITE FOR PRICE LIST AND SAMPLE.

Anti-Borax Compound Company
FT. WAYNE, INDIANA



A Thermit Reaction

When Reclaiming Broken Steel Sections

By

THERMIT WELDING

from 100 lbs. to over a ton of molten steel at 5000 F. is added to the sections to be united.

This adding of metal ***in bulk,*** together with the intense heat of the Thermit steel causes a thorough amalgamation of the Thermit steel with the steel sections to be welded, thus assuring a homogenous weld on cooling, a result unattainable by other methods.

Let us quickly and reliably reclaim your large broken equipment, such as:

Large Crankshafts	**Roll and Pinion Pods**	**Shears**
Roll and Pinion Necks	**Drop Forge Equipment**	**Housings**

and many other types of heavy steel sections.

Send for Pamphlet 1779

METAL & THERMIT CORPORATION

120 Broadway, New York

329-333 Folsom Street, San Francisco
7300 So. Chicago Avenue, Chicago, Ill.
15 Emily Street, Toronto, Canada
1427-1429 Western Ave., Pittsburgh, Pa.

Factories located at Chrome, N. J., Wyandotte, Mich., East Chicago, Ind., Jersey City, N. J.

BURDETT OXYGEN COMPANY

AND ASSOCIATED COMPANIES

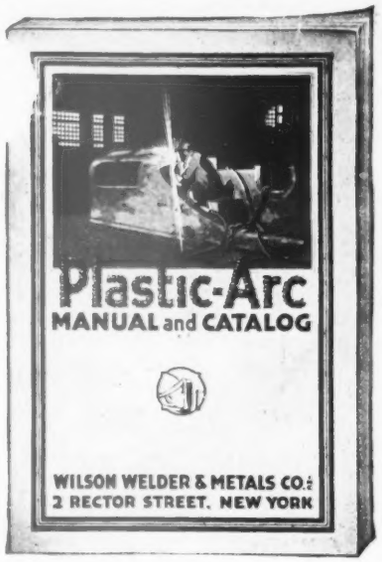
ELECTROLYTIC OXYGEN and HYDROGEN – 99 1/2 % Pure

Service from the following BURDETT PLANTS

Seattle, Wash.
Los Angeles, Cal.
Oakland, California
Salt Lake City, Utah
Denver, Colorado
Oklahoma City, Oklahoma
Fort Worth, Texas
St. Louis, Mo.
Detroit, Michigan
Logansport, Ind.
Chattanooga, Tenn.
Cincinnati, Ohio
Pittsburgh, Pa.
Chester, Pa.
Norristown, Pa.
Cleveland, Ohio
Chicago, Illinois

The Largest Producers of the Purest Oxygen in the World

IT'S READY FOR YOU



This new edition of our manual-catalog is ready for distribution—

It contains 76 pages of valuable welding information—

It is the most complete book on arc welding yet prepared—

SEND FOR A COPY.

This new book of modern welding practise contains detailed descriptions of various welding methods, modern equipment, examples of welding small and massive parts of steel, iron, cast-iron, copper, brass, and aluminum, etc., with explanations that really explain the proper method, heat values, welding metals, etc., to be used for any particular job or line of work. Also a chapter devoted to the repair of the interned German ships, the biggest welding job in the history of the world.

Arc-Welding is a live and important topic. You can be fully informed at the cost of a postage stamp.

SEND FOR YOUR COPY NOW

Wilson Welder & Metals Company, Inc.

2 Rector Street
New York

Equipment for All Purposes

CUTTING TORCHES which use any preheating gas.

INJECTOR TYPE WELDING TORCHES

EQUAL TYPE WELDING TORCHES

REGULATORS THAT REGULATE

TORCHES MADE SPECIAL FOR GAS MANUFACTURERS

The Harris Calorific Co.
PIONEERS
Cleveland, Ohio

AUTOMOBILE WELDING

With the OXY-ACETYLENE FLAME By M. Keith Dunham

167 Pages* Price $1.25 *Fully Illustrated

This is the only complete book on the "Why" and "How" of Welding

Explains in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone.

Gives principles never to be forgotten. Aluminum, cast iron, steel, copper, brass, bronze and malleable iron are fully treated, as well as a clear explanation of the proper manner to burn the carbon out of the combustion head.

Automobile Owners, Garage and Service Stations, Blacksmiths and Machine Shops, as well as industries using the oxy-acetylene flame, will find this book of the utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them shown.

CONTENTS

CHAPTER I.—APPARATUS KNOWLEDGE.
Oxygen Supply—Care of Oxygen Cylinder—Acetylene Generation—Care of Generator—Regulators—Care of Regulator — Creeping Regulators — Gauges—Care of Gauges—Welding Torch—Care of Welding Torch—Effects of Heat—Hose and Goggles.

CHAPTER II.—SHOP EQUIPMENT AND INITIAL PROCEDURE.
Preheating Agencies—Welding Table—Location of Welding Outfit—Starting the Welding Outfit—Adjustment of Flame—Principle of Welding—General Welding Knowledge—Welding Rods and Fluxes—Choice of Tip—Expansion and Contraction.

CHAPTER III.—CAST IRON.
Simple Welding—How to Hold the Flame—Hard Cast Iron—Pin Holes and Blow Holes—Lug on Cylinder—Water Outlet—Cylinder Welding—Compression Head—Finishing and Testing—Scored Cylinders—Cylinder Parts—Fly Wheels—Pistons—Crank Cases — Babbitted Bearings — Valve Guides—Preserving Threads—Conclusion of Cast Iron.

CHAPTER IV.—ALUMINUM.
Use of—Welding Knowledge—Puddle System—Flux System—Comparison of Systems—Welding Rod—Preparation of the Weld—Inlet Manifold—Arm of Crank Case—Welding the Arm Without Taking Out the Motor—Break in the Body of Case—Welding Cold—Wrong Method of Setting Up—Lug or Boss Welding—Preheating the Case—Gas Preheating Flame—One Side or Both—Collapse of Weld—Broken Bearings—Direction of Welding—Shrinkage Cracks—Missing Parts—Finishing—Die Moulded Castings—Body—Other Parts.

CHAPTER V.—STEEL.
Welding Knowledge—What the Flame Does to Steel—The Welding Rod—Simple Welding—Position of Flame—Reinforcing the Weld—Frame Welding—Lengthening the Chassis—Tube Housings—Worn Parts—Gear Welding — Case Hardening — Light Metal Welding—Gasoline Tank—Welding Adjacent to Rivets—Shaft Welding—Construction of Parts.

CHAPTER VI.—MALLEABLE IRON, COPPER, BRASS, BRONZE.
How to Detect Malleable Iron—Brazing Malleable Iron—Rear Housing—Reinforcing the Braze—Brazing Tube to Housing—Building Up Worn Parts—Copper—Brass and Bronze—Silver Soldering.

CHAPTER VII.—CARBON BURNING AND OTHER USES OF OXYGEN AND ACETYLENE.
Principle of Carbon Burning—Method of Operation—Lead Burning—Soldering—Case Hardening—Heating Uses.

CHAPTER VIII.—HOW TO FIGURE COST OF WELDING.
Oxygen Consumption—Dissolved Acetylene Consumption—Torch Consumption Test—Acetylene Generator Consumption—Cost Card—Conclusion.

Sent to any address Postpaid on receipt of $1.25 **THE WELDING ENGINEER** 608 So. Dearborn St. CHICAGO ILLINOIS

All You Want Where You Want It When You Want It

NO matter how much nor how little Oxygen you require—nor how your rate of consumption varies—nor how sudden your need for a large quantity. . . . There are 65 Linde Distributing Stations, located where one or another will meet your needs without interruption.

519

The Linde Air Products Company

Largest Producer of Oxygen in the World

30 East 42d Street
New York

KOHL BUILDING
San Francisco

THE PROCUREMENT AND DIS-

TRIBUTION *of* NON TOXIC GASES *in* THE A. E. F.

By Major Paul Pleiss, Balloon Section Air Service, Officer in Charge

SO much has been written of the war, of the work carried on by The American Expeditionary Forces in France that it is conceivable that the reading public in general has lost a great deal of its earlier interest. To those of us so fortunate as to have been part of that force the subject of its accomplishments is still vivid, not beause we are living over those strenuous days but because we feel that some good can come of the sacrifice and effort in the lessons that it has taught. The subject of non-toxic gases has not been featured in the articles on the war and it is with the belief that the readers of *The Welding Engineer* will be interested in the subject that this article is written. The lesson that this one phase of the activity most clearly brought out was the advantages of co-operation and consolidation of effort.

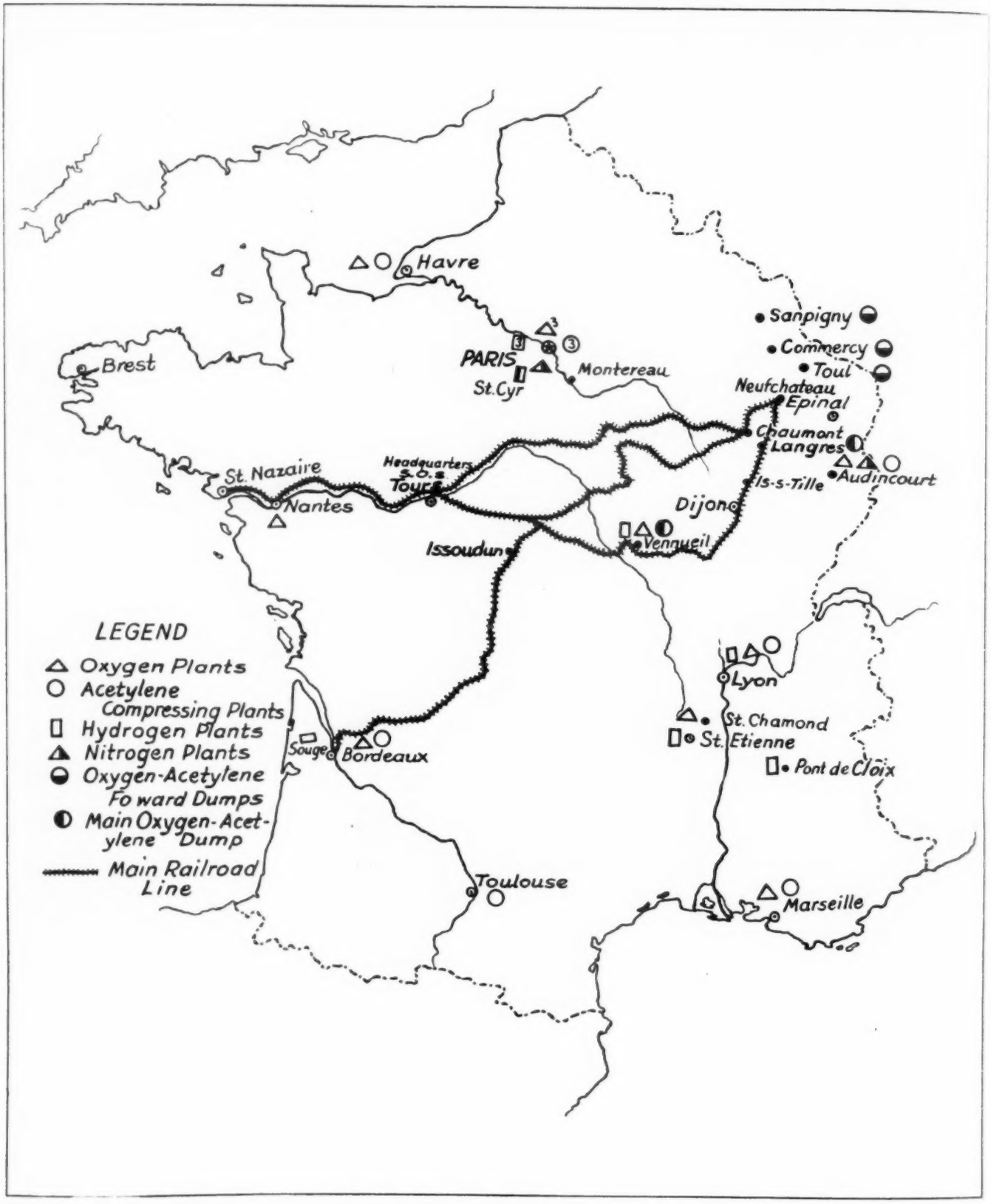
Major Paul Pleiss.

The term, non-toxic gases, was a generic one adopted to embrace oxygen, hydrogen, nitrogen and acetylene, as distinguished from toxic or poison gas. Because the condition of manufacture, distribution and use were so widely different no attempt was made to consolidate these two dissimilar activities and the two organizations remained separate.

Up to the time of the declaration of war, except at some of the army owned arsenals and to a limited extent on the border, little use was made of the oxy-acetylene process and little was known of its possibilities. Hydrogen had been used by the Balloon Section but its use was intermittent and in small quantities. So far as is known no nitrogen was used in the recoil mechanism of guns prior to our entry into the war. The result of course was that there were few officers in the regular establishment that were familiar with the subject of non-toxic gases and as a consequence these gases did not occupy the same position of importance that they later assumed. One officer of the regular army did appreciate the possibilities of the oxy-acetylene process, gained by his experience on the border, he was Col. H. A. Hegeman who was in charge of the Motor Transport Division of the Quartermaster Corps.

Col. Hegeman visualized the need for oxygen and acetylene in France and was prompt in taking steps to prepare for his estimated requirements. The Balloon Section because of the essential nature of hydrogen for its work set about to arrange for supplies both here and in France. A generous estimate of its cylinder requirements was made and during the early summer a total of 70,000 standard high pressure cylinders were purchased. The Motor Transport Division placed a contract for an electrolytic plant with a daily production capacity of 20,000 cu. ft. of oxygen and double that amount of hydrogen and a complete acetylene generating and compressing plant with a daily capacity of 40,000 cu. ft., all for installation at their base shop in France, wherever that was to be located. Because this initial plant represented the beginning of what was thought would be an important source of hydrogen in France, the Balloon Section made arrangements to purchase sufficient equipment to double the capacity. The Motor Transport Division were to operate the complete plant and to receive the total oxygen production and the Balloon Section was to receive all of the hydrogen production except minor supplies that were needed at the shop for storage battery lead burning. This pooling of resources marked the first step towards a consolidated effort along gas lines, the second step was the formation by order of a committee for the purpose of "co-ordinating the compressed gas supply to be used overseas." The committee was made up of four members, representing Ordnance Department, Corps of Engineers, Motor Transport and the Balloon Section of the Air Service, represented by the writer as recorder. The committee, by the terms of the order creating it, was empowered only to make recommendations and it had no authority to enforce its recommendations. One recommendation that was made and fortunately carried out was standardizing the colors of cylinders to distinguish their gas content, this was the means of avoiding a great deal of difficulty in France and explans perhaps the total absence of accidents. Because of the limited authority and perhaps also because of lack of knowledge of conditions in France no steps were taken to consolidate the non-toxic gases and the result was that each branch of the service worked along independent lines.

Lack of officers with gas experience and the absence of a directing head controlling the noh-toxic gases permitted the need of cylinders for operations in France to pass unnoticed. The neglect to purchase cylinders during the summer of 1917 when the cylinder factories were comparatively. idle made itself felt in France even up to the close of hostilities. This shortage, which could have been avoided, resulted in wholesale cylinder requisitions placed by the A. E. F. on the United States during the summer and fall of 1918 which meant the diversion of cylinders from industrial uses. In France it restricted the uses of gases and made a difficult supply situation more difficult.



Map Showing Location of Plants and Source of Supply for A. E. F.

During the months of December, 1917, and January and February of 1918 the officers who were to serve as the basis for the Service of Supplies organization in France left the United States. The Service of Supplies, that organization created to serve the combatant troops, up to April went through a chaotic condition precedent to becoming thoroughly organized. Supplies of oxygen and acetylene were usually obtained by the user from any possible source and at any price. Nitrogen was not being used to any extent. The Balloon Section, because its organizations were serving with the French, merged its supply of hydrogen with the French supply which at that time was fortunately adequate.

A list of the uses of the non-toxic gases will give an understanding of the problem of distribution that was faced by all organizations.

Oxygen and acetylene were used by:

Motor Transport Corps, at all points where vehicles were repaired, inspected and received. With all mobile repair shops there was included an oxy-acetylene welding and cutting outfit. All motorcycles and many of the trucks required acetylene for their lights.

Ordnance Department, at all base shops and with all mobile shops in the field there was included a welding and cutting outfit.

Air Service, at all depots, all repair parks, at all schools and with each squadron in the field. Oxygen was used for breathing purposes by aviators. Many of the night landing fields were lighted with acetylene.

Corps of Engineers, at all depots and shops which included the locomotive and car construction and repair shops. Many of the Engineer troops in the field carried welding and cutting outfits.

Medical Corps, oxygen for resuscitation of gas casualties in the field and at hospitals. Acetylene was used for heating and lighting field dressing stations and hospitals.

Chemical Warfare Section, for experimental purposes.

Hydrogen was used by:

Air Service, by all balloon organizations for the inflation of balloons.

Signal Corps, Meteorological Section, for use in sounding balloons to determine the wind velocity for the Air Service and the Artillery.

General Staff, for use in balloons carrying propaganda literature into and over the enemy lines.

Nitrogen was used by:

Ordnance Department and the Artillery in the recoil mechanism of some 75 and 155 mm. guns.

Air Service, by the medical board for examination of flyers by simulating high altitude conditions.

All the gas used was in the compressed form. The demand extended from the Ports of Debarkation to the front line in the Zone of the Advance wherever and whenever troops were found and that embraced nearly the whole of France. In an attempt to cope with the distribution problem the Gasoline and Oil Branch of the Quartermaster Corps tried to stock a supply of gas at some of their gasoline refilling stations and while it was a distinct step in advance they had not the authority to control the movement of cylinders for other services. Each service handling its own requirements with no individual directly responsible resulted in needless shipments of cylinders, often cylinders were shipped from Bordeaux to Paris (350 miles) to be refilled and returned when there was a factory in Bordeaux capable of filling all requirements. This same thing was happening to a lesser degree all over France and a cylinder shortage was bound to result. The production facilities of existing commercial plants was adequate for our needs but the shortage of cylinders, caused in part by needlessly long shipments, resulted in the summer of 1918 in an extreme shortage of oxygen and acetylene. Because the Balloon Section was provided with sufficient cylinders and because the supply of hydrogen was merged with the French no shortage was felt.

Because the writer was connected with the oxygen and hydrogen industry prior to his entry into service he probably saw the conditions more clearly than others. A consolidation of supply and procurement of non-toxic gases, backed by authority was the only possible solution of the difficulty. During the early part of May a conference was held with officers of the Quartermaster Corps for the purpose of pointing out to them the necessity for action in order to improve conditions. The officers of the Quartermaster Corps were enthusiastically in favor of a consolidation but other departments of the Army took other views and hesitated to turn over to some other department the supply of one of their requirements. The negotiations, if they may be called that, were carried on during the months of June and July and converts to the idea of a central responsible organiaztion were being made. It was pointed out to other branches the need for securing supplies of cylinders and some action was secured. Cylinder orders were placed in France to the extent of capacity of the factories, there was an excess of Hydrogen cylinders in France and some of these were converted for use as oxygen cylinders and cables were sent to the United States making known the extreme demand. Finally the consent of all branches of the Service was obtained to have the Balloon Section of the Air Service handle all procurement and distribution of non-toxic gases. The Air Service is not considered as a supply branch of the Army but in this instance it appeared that the A. E. F. would be better served by the Air Service than by any other branch because,

First. The Balloon Section of the Air Service was by far the largest user of non-toxic gas (hydrogen) and was shortly to become the largest producer.

Second. It had had more experience in distributing gas than any other organization and

Third. It had more personnel trained in gas handling.

As soon as the informal consent of all branches was obtained and in advance of the issuance of the official order, steps were taken by the Balloon Section to handle the problem. The first step was the concentration of the organization to consider and decide on the policy of distribution to be adopted and at the same time to make a survey of the non-toxic gas producing facilities of France. Fortunately by this time the supply of hydrogen had been stabilized and that was one problem less.

Distribution System Adopted.

The distribution of supplies in France was divided as to organization in the Service of Supplies and to organizations in the Zone of the Advance. This represented a logical division of distribution for non-toxic gases and it was adopted.

System of Supply to Organizations in the Service of Supplies.

A survey was made of the gas requirements of all organizations in order to determine the extent of their cylinder needs. The organizations' cylinder requirements were controlled by the following factors, estimated consumption per day, their proximity to a production plant, and the average length of time taken to turn over cylinders. When the actual cylinder requirements were determined every effort was made to supply cylinders to the extent needed. In some cases it was found that organizations had accumulated a large surplus of cylinders while perhaps even in the same city another organization was located that had an inadequate supply. The concentration of authority made possible the pooling of all cylinders for the common good of all users.

In each instance, after individual cylinder requirements were filled, the user was notified as to his nearest supply of gas and the responsibility for maintaining his supply of gas by the rapid turnover of cylinders was placed on the user. So far as conditions permitted it a stock of cylinders was kept on hand at the various production plants so that the user would not be required to wait until the cylinders returned by him were filled. Empty cylinders were sent to the factories, usually by truck.

and the driver was given a requisition in duplicate by the organization commander. One copy of the requisition was retained by the firm supplying the gas and the other accompanied the firms invoice at the end of the month. Blanket contracts were placed with all of the producing firms for gas supply from all of their factories. All invoices from the firms were forwarded to and paid by the Paris office of the Air Service. In order to comply with the Army System of Accountability all users there were rebilled for the amount of gas used by them. In the event that an organization required cylinders, because of increased consumption, beyond the number originally allotted to it, a separate requisition was made out by the organization and forwarded for accomplishment to the Paris Office of the Balloon Section.

Practically every organization in the A. E. F. used one or more of these gases, perhaps it was only for the refilling of a motorcycle cylinder but the demand had to be met. The principle first adopted of making the individual user responsible for the turnover of his supply of cylinders and permitting him to secure his gas requirements direct from the factory without the necessity of passing a requisition through headquarters was adhered to throughout the period. The supply of cylinders was too inadequate and the need for the gases was entirely too urgent to permit the delay that would be caused by routing requisitions through the regular channels.

Within two months after the Balloon Section took over the distribution the supply was automatic and on a satisfactory basis, there were of course exceptions, cylinders lost, organizations moving, shortage of carbide, unexpected demands, etc., but in general the new system was a great improvement over the old method.

Sources of Non-Toxic Gases.

The main sources of non-toxic gases are shown by the accompanying map.

There were ten sources of Oxygen, eleven sources of Acetylene, twelve sources of Hydrogen and two sources of Nitrogen. A total of production of nearly two hundred thousand cubic feet of Oxygen, one hundred and fifty thousand cubic feet of Acetylene (if carbide was furnished), three hundred and fifty thousand cubic feet of Hydrogen and forty thousand cubic feet of Nitrogen was available per day for the use of the A. E. F. from the sources shown on the map. In the early days a great deal of difficulty was experienced in securing supplies of compressed acetylene due to the shortage of carbide in France and to remedy the situation, nine hundred tons of carbide was purchased in Spain for immediate delivery and requisitions were placed on the United States for monthly shipments of two hundred tons. As the shipments arrived the carbide was turned over to the commercial firms and the acetylene shortage disappeared.

The Army owned and operated sources of these gases, included in the totals above were, Oxygen twenty-thousand cubic feet per day, Hydrogen forty thousand cubic feet per day, Acetylene forty thousand cubic feet per day which was to be increased to one hundred and sixty thousand feet per day with the completion of the Ordnance plant in course of construction at Mehun. There was no army source of Nitrogen. No apprehension was felt that the supply of Oxygen, Acetylene and Nitrogen would not prove adequate for all demands to the end of 1919 but there were grave doubts as to the supply of hydrogen. The expansion of the balloon program and the increasing needs for hydrogen for sending propaganda literature into Germany indicated that there would be a serious shortage of hydrogen in the Spring of 1919 and the decision was made by the Balloon Section to erect a hydrogen plant large enough to fill all needs. A study of conditions determined the selection of the iron contact as being the most suitable process for hydrogen production. An abandoned illuminating gas plant was found on the outskirts of Paris and it was planned to convert this into a hydrogen plant. The plans were commenced in September and were finished in detail two days after the Armistice. The plant was designed to have a daily capacity of 500,000 cubic feet which would have made it by far the largest hydrogen plant in Europe. All the material for construction with the exception of compressors was to be secured in France.

Supply of Gas to the Zone of the Advance.

The method adopted by the A. E. F. for the supply of combatant troops was by means of dumps, usually located at a railhead, and convenient to the organizations it was to supply. Quite naturally this same method of supply was adopted for gases. Practically each branch of the Service had its own dump, sometimes all were concentrated at some favorable location but more often the dumps were scattered as a safeguard against enemy air attack. It was not deemed advisable to start separate dumps for handling gas and arrangements were made with the Motor Transport Corps to share their dumps. The arrangement was mutually sastisfactory, they were the largest users of Oxygen and Acetylene and were naturally interested in having charge of the stock of gas while to the Balloon Section it meant the solution of the transportation problem. There was a constant flow of trucks to and from Motor Transport dumps and these vehicles were utilized to carry forward full cylinders and return empty cylinders. The main Motor Transport dump was located at Langres, thirty miles south of Chaumont, the American General Headquarters, admirably located on the main line of railway communications from the ports to the front occupied by American troops. At this point in connection with the Motor Transport Corps the main cylinder dump was located and the first aim of all was to concentrate at this point as many full cylinders as possible. At Toul, Sampigny and Commercy, in connection with Motor Transport dumps, auxiliary cylinder dumps were established to supply directly the demands of the First and Second Army. At Columbey-les-Belles, an Air Service depot, a small dump was established. The supply of Oxygen and Acetylene for these dumps was secured from the Langres dump and that dump in turn shipped empty cylinders to either the Motor Transport Reconstruction Park at Vernueil, one hundred miles southwest, or from the plants of the Air Liquide at Audincourt, sixty miles east. Empty cylinders were turned into the auxiliary cylinder dumps by organizations and were then forwarded to Langres. Organizations, except those stationed nearer to Langres, drew their gas supply from the four auxiliary dumps. The main dump at Langres may be likened to a reservoir controlling the flow of cylinders, that is, the dump received empty cylinders from the forward or auxiliary dumps, shipped full cylinders in an equal amount forward, and arranged for refilling all empty cylinders. Organizations requiring either an initial allotment of cylinders or additional cylinders were supplied direct from the dumps on requisition but so far as it was possible the rule of exchanging only an equal number of full for empty cylinders was adhered to. It was only by this means that the limited number of cylinders available were kept in rapid circulation and accumulations of cylinders were prevented. Like the distribution system adopted for the S. O. S. the user was made responsible for maintaining his supply of gas by his rapid turnover of cylinders. The stock of cylinders kept at dumps was a floating supply that permitted the exchange of cylinders without the necessity of waiting for refilling. The transportation of cylinders was carried out almost entirely by motor truck, the congestion of the railroads and the shortage of cylinders made this imperative. Hydrogen to Balloon organizations in the Zone of the Advance was supplied by separate dumps located ten or fifteen miles from the line and nearly always in connection with French Hydrogen dumps. The dumps were required to be nearer to the line than Oxygen and Acetylene dumps in order to permit hydrogen being quickly

brought forward to inflate a new balloon to replace one burned by the enemy. Back of these forward dumps were located main dumps, called "centres d'Hydrogene" by the French, their function was exactly similar to the functions of the Langres dump. One or two forward dumps were sufficient to supply the hydrogen requirements of balloon troops serving with an army of say 70,000 cubic feet per day. Up to the time of the signing of the armistice only small amounts of Nitrogen were used, as the demand increased it was planned to distribute this gas from the dumps established for Oxygen and Acetylene.

Weekly reports were received from all dumps showing the cylinder movements of the past week and on the basis of these reports organizations were invoiced for gas drawn by them. The organization handling the non-toxic gases was located in Paris and from that point all billing was done. The officer or non-commissioned officers in charge of the cylinder dump had authority to issue cylinders to organizations in the amount he deemed necessary, he was as well charged with the responsibility of maintaining a full stock of cylinders at his dump.

The distribution system was running on a smooth basis when the Armistice was signed but the signing of the Armistice did not mark the end of the demand for gases, rather it marked an increase in consumption. During the period of hostilities in the Zone of the Advance no vehicle was allowed to burn headlights and as soon as this order was rescinded every motorcycle in the Z of A required a full cylinder of acetylene. The close of hostilities saw the beginning of an extensive vehicle repair program and there were nearly forty thousand that required repairs. The consumption of Oxygen and Acetylene jumped enormously in the months of November and December and the supply became more difficult because of the extension of area covered due to the formation of the Army of Occupation. An additional dump was established at Coblenz in the occupied territory. January saw the peak of the demand which shrunk month by month until in May the only organization using Oxygen and Acetylene was the Motor Transport Corps. This centralized use made a separate organization for its supply useless and accordingly the responsibility for the procurement of Oxygen and Acetylene was turned over to the Motor Transport Corps and the Air Service except for the supply of Hydrogen retired from the field.

No accurate figures are available on the total number of cylinders that were used in France. It is safe to say that upwards of 125,000 were in service, of this number the Balloon Section had 50,000 hydrogen cylinders, approximately 40,000 motorcyle cylinders were in service 500 nitrogen cylinders and the balance made up of oxygen and acetylene cylinders about equally divided. All hydrogen cylinders were purchased in the United States, oxygen, nitrogen and acetylene cylinders were of all kinds, sizes and shapes and secured from every possible source with not a few among them captured from the enemy during the Marne offensive. Cylinders manufactured in France were required to undergo tests very similar to the tests prescribed by our own Interstate Commerce Commission. There is no record of a single cylinder in the A. E. F. blowing up and in view of the conditions under which they were used this record is remarkable.

PARIS OFFICE—BALLOON SECTION.

Sitting, left to right: Miss M. Vuillemot, 2nd Lieut. E. E. Denniston, Captain Paul A. Beaton, Major Paul Pleiss, Lieut. Parr H. Dole, USNRF., 1st Lieut. Robert von Ezdorf, Miss E. French.
Standing, left to right: Private Ralph B. Strickland, 1st Lieut Luther H. Johnson, 2nd Lieut. F. H. Tomkies, 1st Lieut. James Zipf, Private William K. Warden.

Gas Prices.

Not the least important of the results obtained by consolidating the non-toxic gases was the decrease in prices paid for Oxygen and Acetylene. The centralization of purchasing power reduced the price on Oxygen by 150 per cent, on acetylene by 55 per cent. The average price paid for Oxygen, in Army cylinders with transportation paid by the Army was $7.84 per thousand cubic feet. The price paid for acetylene under the above conditions was, if carbide was furnished, $12.57 per

thousand; if carbide was not furnished, $47.29 per thousand cubic feet. The price paid for carbide in Spain was $142.00 per ton of 2,000 lbs. for a quality not equal to that supplied in the United States.

Non-Toxic Gas Organization.

It was nominally a part of the Balloon Section, Air Service but acted to a great extent as an independent unit, its members were:

Major Paul Pleiss, Officer in Charge.

1st Lieut. C. B. Price, in charge of distribution in the Zone of the Advance.

2nd Lieut. E. E. Denniston, in charge of distribution in the S. O. S. and procurement of gases by contract.

Capt. Paul A. Beaton, in charge of accounting.

Lieut. Parr H. Dole, USNRF, in charge of design of Hydrogen plant.

Lieut. Robert Von Ezdorf, assistant.

Lieut. L. H. Johnston, assistant.

Mlle. Buillmot, stenographer and clerk.

Mlle. French, stenographer and clerk.

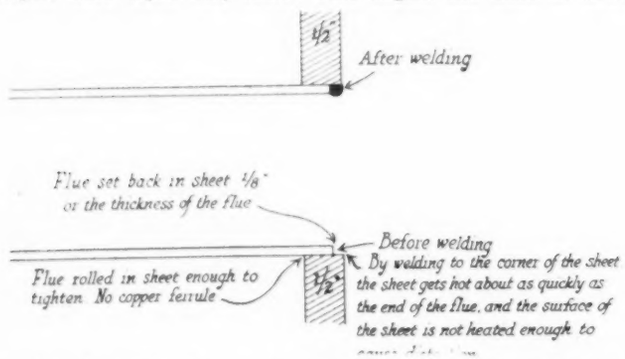
Mlle. Lamine, stenographer and clerk.

Future Plans.

It was planned by the non-toxic gas organization, after the distribution system was stabilized, to become a service organization for the development of the use of the oxy-acetylene process and to co-operate with organizations in the United States that were training welders. This, like so many other things planned, was stopped by the Armistice. The fact that the supply of gas was on a workable basis unquestionably did contribute to a wider application of the oxy-acetylene process. The process did its share of the work in France but had the supply of gas been centralized in the beginning its applications would have been a great deal more important. Much valuable time was lost before this salient fact was realized, that unified control backed by authority was essential. It was not so much that the organization made a success of the distribution of gases but it was the principle of centralizing similar activities that made for success. A great deal of credit is due the Chief of the Balloon Section, Col. C. deF. Chandler, for his efforts in assisting in the preliminary negotiations for the consolidation and after the consummation giving the organization a free hand in the problem.

WELDING LARGE FLUES.

Editor: I am sending you a sketch of my method of welding superheater or large flues in back flue sheet of locomotive. I welded a set of 26 flues in this manner in a large passenger engine here April 8th, 1917. This engine has been in active


1/2
After welding
Flue set back in sheet 1/8" or the thickness of the flue
Before welding
By welding to the corner of the sheet the sheet gets hot about as quickly as the end of the flue, and the surface of the sheet is not heated enough to
Flue rolled in sheet enough to tighten. No copper ferrule
1/2

service since this date and none of these flues have leaked a drop.

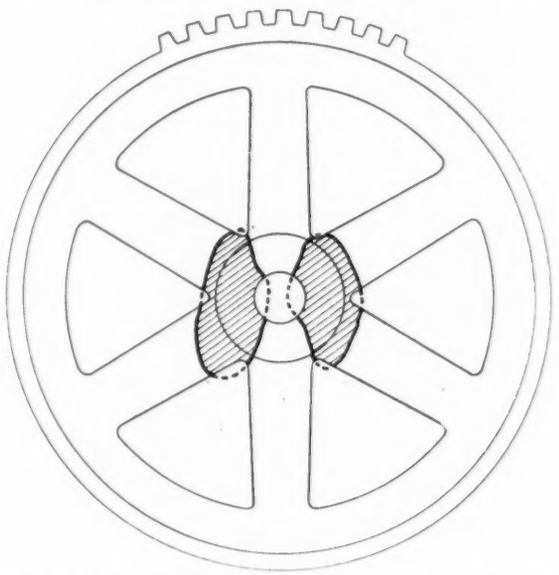
The life of a set of flues installed in the old way is from 8 to 11 months. The flue holes in this flue sheet were out of round from constant rolling and prosser and had the flues been renewed in the old way by rolling, prossering and bending on the fire end, this sheet would have had to be replaced by a new one or a new top half welded on. A few months after I welded in this set of flues, I happened to be talking to a boilermaker foreman at another point on this railroad, the name of which I cannot state at this time, as I have not permission to do so, and while in conversation told him about welding in the flues in this manner and advised him to try a set. Up to this time he has 19 engines in services with flues welded in this manner, and not a one of them has given him any trouble whatever. I left the employ of the Railroad Company shortly after welding in these flues and they have not tried any more at this point.

A few months after welding in these flues I wrote several welding equipment companies and sent them sketches of this work. But they all seemed to think that the job would not hold up, saying that the vibration of the flues, which are 20 feet long, would pull the welds loose or break the flues behind the weld. I think that my two years test proves that they will do neither. If these flues do not pit inside the boiler they will last indefinitely. I hope that his letter and sketch will be of some benefit to you and the readers of the *Welding Engineer*.

William Tucker, Jr.

WELDING LARGE GEAR WHEEL.

Editor: I am sendin the details of a welding job that I think will be of both interest and benefit to your welder readers. This job was a gear wheel about 62 inches in diameter. It had two breaks at the hub which was 16 inches in diameter, 12 inches thick and had a 6½ inch bore. Two pieces were broken



out of the hub, running well down in the spokes. This job was done cold without any preheating whatever. As great care had to be taken to keep the heat and expansion out of the spokes and rim while welding and cooling, it made it a ticklish job. As this job had to be done as quickly as possible to keep it from getting too hot, a mold was made out of fire brick and fire clay to fit the break. The hub and spokes were packed with wet asbestos to keep the heat out of the spokes and rim. Enough welding rods and flux were at hand to finish the job before the start was made. Four large welding torches with No. 12 tips were used and the flame was played toward the center to keep the heat from going in the wrong direction. An assistant was at hand to render all possible aid to assure a speedy finish of the job, thereby keeping it from cracking. After welding, the spokes were again packed to keep out all possible strains. About 40 lbs. of cast iron was used. Diagram shows location of break.

Cleveland, Ohio. Wm. Deike.

WELDING SPECIALISTS

Leading Welding Shops of the United States, equipped to handle unusual and difficult welding and cutting work. We send men anywhere and guarantee work. Prices reasonable. Correspondence solicited.

ONE of the largest and best equipped job welding shops in the United States. Our men are experts. No job too large or too complicated. Work guaranteed—prices reasonable.

When in trouble send for our man

Torchweld Equipment Co.
Fulton and Carpenter Streets, Chicago

Portland Brazing & Machine Wks.
266 Glisan Street
PORTLAND, - - OREGON

The Big 4 process Shop

Electric — Thermit—Oxy-acetylene and reinforced brazing.

The Northwest Distributors of REGO Apparatus

Rochester Welding Works

We not only do welding, but supervise the design and installation of oxy-acetylene welding plants; report on welding material and methods; make tests on welding apparatus for efficiency and economy.

Nine years' experience.

Rochester Welding Works
349 Orchard St., Rochester, N.Y.
S. W. MILLER, M. E., Proprietor

Davis-Bournonville Co.
147 W. Austin Ave. Chicago

Davis-Bournonville Co.
Marion Jersey City

Davis-Bournonville Co.
316 Penn Ave. Pittsburgh

Texas Headquarters for Welding and Cutting. The Best Equipped Plant in the State.

Southern Welding & Machine Co.
212-14 College Street
San Antonio, Texas

WE weld broken machinery and auto parts. Aluminum crank cases a specialty. Welders and brazers of all metals. Custom welding for the trade. Let us figure on your requirements. Imperial Brass Mfg. Co., Welding Dept., 508-510 S. Racine Ave., Chicago, Ill.

M. C. GREEN
Consulting Engineer
Instructor in pre-heating, welding, cutting and brazing.
Manufacturer of pre-heating, heat-treating, melting and brazing burners.
Office and Demonstration Plant
325 Campbell St., Williamsport, Pa.

GOOD welding shops are an asset to any community. They should be encouraged and helped. The Editor of The Welding Engineer will be glad to have information and photographs relating to any successful job welding shop.

This page is intended to be a directory of America's best shops. The cost of advertising is low. Write for details.

F. Mackenzie

DAVIS-BOURNONVILLE CAMOGRAPH No. 2.

One of the late developments of mechanically-guided cutting torches made by the Davis-Bournonville Co. is the Camograph No. 2, for cutting hand-holes and other openings in steel plates. This machine is illustrated on Page 5 of this issue. The No. 2 Camograph is an improvement and refinement of the original Camograph which was designed especially as a maintenance-of-way tool for cutting slotted holes in the ends of street railway rails for the fish-plate bolts. The older Camograph is hand-operated, and is limited in its scope to comparatively small holes, whereas the new machine has larger capacity and is more general in its application. The torch is mechanically traversed at a pre-determined rate, thus insuring steadiness and smoothness of operation. The No. 2 Camograph has some of the characteristics of a portable Oxygraph, but with the important difference that no tracing wheel is provided for following a paper drawing. Being intended for repetition cutting exclusively, the torch is made to follow a fixed path automatically. The contour of the cut may be changed by providing another metal form only.

The No. 2 Camograph was designed especially to cut hand holes, in boiler plates, and similar openings in ship plates and other wrought iron and steel sections. The flame perforates the steel, and at the path traversed is controlled by an internal cam at the top, the shape of which determines the shape of the opening made. The machine is admirably suited for cutting all openings in steel plates that cannot be produced quickly and economically on a drilling machine. The larger size openings, even if circular, can be cut quickly with the No. 2 Camograph; it has the advantage over a drilling machine that no expense is incurred for special cutting tools and very little power is required to drive it. A hand hole having a periphery of 12 to 13 inches can be smoothly cut in ½ to ⅝-inch steel plate in one minute.

The machine comprises a cast iron base with a U-shape opening through which the torch flame strikes the work beneath. At the back of the base is a verticle post to which a double-jointed radial arm is pivoted. The cutting torch is mounted on the outer end of the radial arm, which provides for movement in any direction over the entire area covered. The jointed arm is made of two aluminum castings of light but rigid construction; these are mounted on ball bearings which offer a minimum of frictional resistance.

A feed roller on the outer or free end of the radial arm is surrounded by a yoke in which is placed the guiding internal cam or templet required to control the movement of the torch. The principle of cam guiding action is unique: The feed roller is magnetized by a powerful electro magnet, and is thus attracted to the inner face of the cam, the parts in contact being made poles of the magnet, one of which rotates and thus acts as a traction driver.

The traverse movement or feed is provided by a small variable speed electric motor mounted on the swinging radial arm. The motor drives the feed roller through a double worm reducing gear, and the magnetic pull provides for the necessary traction. The electric current that operates the motor also serves to energize the electro-magnet by which the feed roller is held to the cam face. Direct current is required.

The shape of the opening cut in the plate being determined by the shape of the cam, it is necessary, therefore, to provide a cam plate for each shape required. The cam plate fits into a circular opening in the yoke or cam holder, and is readily removed and replaced by another. The nominal diameter of the largest hole cut with the No. 2 Camograph is 7 inches, but openings other than circular, having one dimension much larger, may be provided for. All thicknesses of plates used on the largest marine boilers are readily cut; while intended for cutting commercial steel plates only, the power of the torch is ample for cutting much thicker metal, should it be required.

The electrical control is a double push button switch for starting and stopping, and for energizing the magnet. The speed control is effected by a small knurled disc on the motor itself. The torch is provided with interchangeable cutting tips of the sizes required for the range of thicknesses to be cut. The electrical control is connected with the torch oxygen valve. In the top of the vertical post for lifting the machine on and off, feed motion automatically starts and continues until the full circle has been cut out. When cutting holes in plates and using the torch for perforating, it is necessary, of course, to perforate inside the cutting line in order to cut a smooth contour; a secondary cam is provided as a switch to guide the feed roller to the main surface. Hence, the operator lets the machine operate automatically as soon as the cutting oxygen is turned on.

The No. 2 Camograph may be placed over a low base when used for cutting holes in heavy plates, or over a work-bench when required for cutting lighter work that can be more conveniently handled at bench height. A screw eye is provided in the top of the vertical post for lifting the machine on and off the plates with a hoist.

WELDING SAW TEETH

Editor: In the September issue of the *Welding Engineer* you printed an inquiry for information concerning the welding of saw teeth.

I am enclosing, herewith, a copy of a letter received from Mr. H. C. Atkins, President of the E. C. Atkins & Co., which concern, as you probably know, is one of the largest manufacturers of saws.

If you think the information in this letter will be of any value to your readers, you are at liberty to use any part of it that you may see fit.

THE ALEXANDER MILBURN COMPANY
E. C. McNutt,
District Manager.

Mr. E. C. McNutt,
Care The Alexander Milburn Co.,
Pittsburgh, Pa.

Dear Sirs:

Your valued favor of the 22nd inst., is at hand enclosing a clipping regarding the welding of teeth on circular saws with the acetylene process.

We have an acetylene plant here in our factory, and have attempted the same thing, and with the same results you mention. The cause for this is the fact that the acetylene process melts the steel, and the fierce heat applied burns out the carbon rendering the structure very weak, brittle and porous.

If the whole piece is heated red hot, and the welding done in that way, usually somewhat better results are obtained, but even when the pieces are welded red hot that strong homogeneous structure of saw steel is utterly destroyed, and a weak, brittle structure is substituted at the point where the welding is done. This structure is not amenable to the work of a saw and, consequently the break occurs.

We never attempted to weld a tooth on a circular saw with the acetylene process. We have tried it with an electric welding process with somewhat better results, and even that process is entirely unsatisfactory and should only be used as a makeshift. We consider that a saw is better without the tooth than it is with a tooth welded in in this way.

We have spent a great deal of time on this particular item and do not consider the welding of teeth in saws a satisfactory proposition.

E. C. ATKINS & CO.
H. C. Atkins, Pres.

SCORED CYLINDERS

and cracked water jackets successfully repaired. Our factory nearest you will make these repairs on a 24-hour service basis.

Regrinding of cylinders that have been scored by wrist pins or through other causes is unnecessary. The Lawrence Patent Process fuses a silver-nickel alloy into the defects making a quick, clean, permanent job **without altering the bore of the cylinder.** Same piston and rings fit.

Cracked Water Jackets are Also Made Permanently Good through this Same Process

A list of our factories and licensees is given below. There is one near you. Send your scored cylinders and cracked water jackets to the nearest plant. There we will insure you quick service and perfect results. Aside from the liberal arrangements we make with you, the money saving service you render your customers will help make you known as a concern that looks after their interests—and this is a business asset in itself.

We guarantee all of our work. Write to any of our factories for full information.

PLANTS

Buffalo—10 Summer St.
Chicago—1522 Michigan Ave.
Cleveland—6529 Euclid Ave.
Detroit—1246 E. Jefferson Ave.
Los Angeles—1030 S. Grand Ave.
Milwaukee—18 Martin St.
Minneapolis—14 N. 9th Street.
Newark—292 Halsey Street.
New York City—791 Eleventh Ave.
Philadelphia—1601 Summer St.
Pittsburgh—5102 Baum Blvd.
San Francisco—116 Hyde St.

LICENSEES

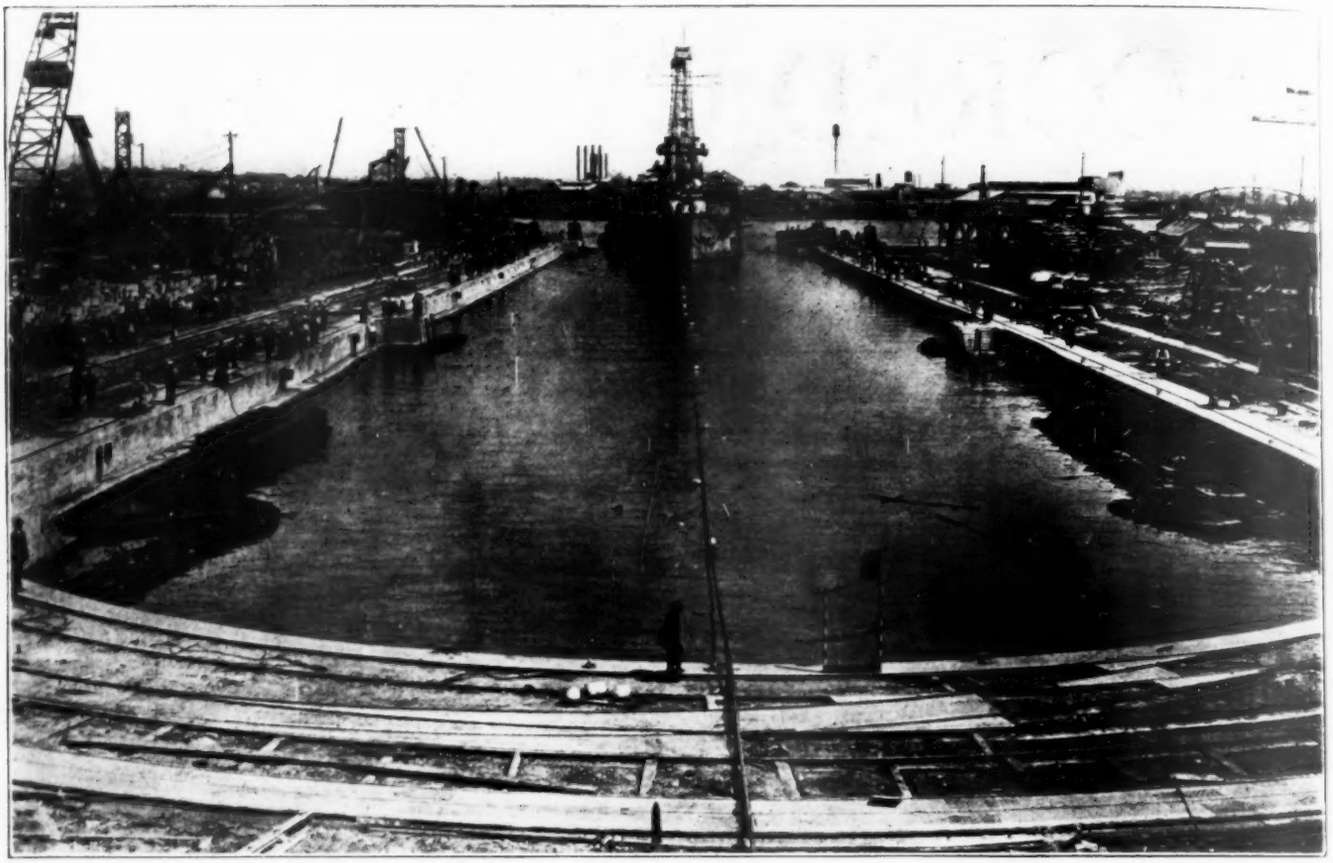
Akron, Ohio—Akron Welding Co.
Amsterdam, N. Y.—Matthew Harrison, 58 Union Street.
Bridgeport, Conn.—United Welding & Repair Co., 172 Elm St.
Cincinnati, Ohio—Cincinnati Welding Co., 410 Richmond St.
Columbus, Ohio—Central Ohio Welding Co., 200 East Lynn St.
Denver, Col.—Blanchette Welding Co., 149 South Broadway.
Erie, Pa.—Lake Erie Welding & Spring Co., 338 W. 12th St.
Grand Rapids, Mich.—Ox-Welding Company.
Harrisburg, Pa.—Harrisburg Welding & Brazing Co., 94 South Cameron St.
Hudson, N. Y.—Hudson Welding & Repair Works, 22 Spring St.
Kansas City, Mo.—General Auto Parts Co., 1621 Grand Ave.
Lima, Ohio.—Buckeye Welding & Repair Shop, 133 Water St.
Memphis, Tenn.—J. B. Cook Auto & Machine Co., 294 Washington Ave.
New Haven, Conn.—New Haven Welding Co., 763 State St.
Portland, Me.—Portland Garage Co., 49 Cross St.
Providence, R. I.—Rhode Island Score Filling Co., 173 Eddy St.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 N. Jefferson Ave.
Schenectady, N. Y.—Franken Oxy-Acetylene Welding Co., 5 Villa Road.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Troy, N. Y.—Reliable Auto Repair Shop, 229 River St.
Washington, D. C.—Day Welding Co., 43 Sumner Court, N. W.
Worcester, Mass.—Central Autogenous Welding Mfg. Co., 98 Union St.
Yonkers, N. Y.—Kipfer Engineering Co., 11 Nepperhan St.
Youngstown, Ohio—C. F. Erb, 722 Madison Ave.
Montreal, Canada—Pyke Motor & Yacht Co., 374 Notre Dame St.
Regina, Sask., Canada—Capital Welding Shop, 1762 Osler St.
Toronto, Canada—Ontario Motor Car Co., Ltd., 18 Bloor St., East.
Windsor, Canada—L. Lawrence & Co., 41 Sandwich St. W.
Melbourne, Australia—Finlay Bros., 322 Elizabeth St.

ESTABLISHED 1862

L. LAWRENCE & CO.

WOOLWORTH BLDG.
NEW YORK CITY

A FEW TERRITORIES STILL OPEN FOR LICENSEES



One of the Six Dry Docks at the Norfolk Navy Yards.

ACETYLENE *In* NAVY YARDS DURING *The* WAR*

By Commander H. G. Knox, Construction Corps, U. S. Navy

BEFORE a gathering representing the International Acetylene Association it would be presumptuous on my part to attempt to tell you the uses of acetylene in Navy Yards. Navy Yards use acetylene very generally and in large amounts for perhaps a greater variety of purposes than do any other industrial concerns.

It would therefore seem much more logical to explain to you what a Navy Yard is and the variety of the jobs it is called upon to perform rather than to detail the uses of acetylene.

The Navy operates a large number of Naval Stations, only a few of which are ship repair yards. The principal Navy Yards for ship repairs are at Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., Philadelphia, Pa., Norfolk, Va., Charleston, S. C., New Orleans, La., Mare Island, Cal., Bremerton, Wash., Pearl Harbor, Hawaii, and Olongapo, P. I. Besides these ship repair yards there are of course many other activities. Among these may be mentioned the Washington Navy Yard, which is exclusively an ordnance manufacturing plant; the Newport Torpedo Station; the new armour plate and projectile plants in West Virginia; and numerous supply and fuel stations, training stations, etc.

Most of the references in what follows will be taken from the activities of the Norfolk Navy Yard, with which I am familiar. This does not mean that the Norfolk Navy Yard is the largest or most important, but simply that I have not the data available from the other yards.

The Norfolk Navy Yard carried on its pay-roll during the war approximately 11,000 officers and men. The mechanics represent over 80 basic trades, with specialists, in addition to this, in many of the trades. Helpers of 20 varieties assist these mechanics, and laborers and other unskilled workers represent well over a thousand men.

For operating and accounting purposes Norfolk has 31 shops and a large supply department. In addition there are several floating cranes, floating work shops, welding and repair barges. A new power plant nearing completion supplies electricity, compressed air, steam and heated fuel oil to the entire yard.

Located 12 miles from Hampton Roads—perhaps the finest anchorage for ships in large numbers on the east coast of the United States—the repair work which developed during the war can be imagined. Besides the Navy Yard there is in this locality the large plant of the Newport News Shipbuilding and Dry Dock Company and a number of small waterfront ship repair shops.

The Navy Yard at present has a berthing space near shops and storehouses of about 5,500 feet, and when the developments now contemplated are completed this will be increased to about 21,000 feet. In addition to the waterfront, with the necessary shops, there are four dry docks now in operation and two nearing completion. One of these docks is over 1,000 feet long, and the largest dock on the

*Paper read at Annual Convention of International Acetylene Ass'n., New York, July 15th, 1919.

ARMCO WELDING RODS IRON

ARMCO IRON Welding Rods cost a trifle more than ordinary welding rods, but the difference is insignificant when other material and labor costs are considered. The superiority of an ARMCO weld, on the other hand, is of inestimable value to the welder who is building up a reputation for quality of work.

99.84 Per Cent Pure Iron

The guaranteed purity of ARMCO IRON Welding Rods insures complete and uniform cohesion and maximum strength of welded section. ARMCO IRON Rods for either electric or oxy-acetylene welding will do all the work (and **better** work) that formerly was thought to require a wide range of welding compositions.

Uniform Composition

The uniform composition of ARMCO Rods, as proven by microscopic and chemical analysis, is another assurance of tough welds that will endure the most severe service. ARMCO Rods flow freely and make a weld that lends itself perfectly to finishing operations.

ARMCO IRON Welding Rods are a strictly American product, unsurpassed by any real or so-called imported iron.

Send for a free supply of these practical Welding Cost Cards

All welding shops should keep accurate cost records. Such records not only insure a profitable charge for every job but also, if properly filed, are an excellent basis for quick and safe estimates on subsequent work.

The card illustrated above itemizes every important cost item and, if filled in where indicated, and preserved, is a very convenient and satisfactory record. Any quantity will be furnished on application, without charge.

The cost of welding rods, compared with the total cost of the weld, is such a small item that you can't afford to buy cheap material.

AMERICAN ARMCO INGOT IRON

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by the American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

Makers of ARMCO Iron Welding Rods and Electrical Wire; "Copperweld" Copper Clad Steel Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stockroom Partitions; Architectural Iron.

Plants: Monessen, Pa., and Adrian, Mich.

Sales Offices: 30 Church Street, New York

CHICAGO: 20 South La Salle Street DETROIT: Book Building

SAN FRANCISCO: American Rolling Mill Company of California

Canadian Distributors: Taylor & Arnold, Ltd., Montreal, Toronto, Winnipeg

STEEL AND WIRE PAGE QUALITY PRODUCTS

50

east coast of the United States. A building slip has just turned out two destroyers, and is now engaged in the fabrication of a 43,000 ton battleship, the North Carolina.

During the war the Navy Yard probably averaged 40 ships, large and small, under repair all the time. In addition to those at the yard, ships were worked on at the coaling piers and anchorages in Hampton Roads.

The number of orders for work outstanding at any time averaged about 14,000. This includes ship work, manufacturing work and plant maintenance.

Figure 11—Cutting Scrap in the Norfolk Navy Yard.

Figure 14-A—(On Right) Water Tight Door Frame Made by Welding Together Pieces of Angles and Plating. (On Left) Parts Clamped in Position Preparatory to Welding.

Figure 16—Steel Fittings Made Out of Scrap Tubing by Oxy-acetylene Welding.

It is almost impossible to specify the scope of a Navy Yard's repair and building activities. Navy Yards build battleships costing $21,000,000 for hull and machinery, which take four to five years to build; destroyers; submarines; transports; repair ships and tugs; and during the war many constructed submarine chasers.

The principal activity or shop of a modern shipbuilding Navy Yard is the structural steel shop. In this shop all of the work on the heavier plates and structural shapes is performed. At Norfolk the new structural shop has a main floor area of 140,000 square feet, with a mold loft of 70,000 square feet. A storage yard for structural steel, in which all of the area is under bridge cranes and under roof, occupies 200,000 square feet. In this yard a stock of structural steel for approximately two years' repair work, with steel storage capacity for whatever new construction is in hand, is provided. The third day of the structural shop building is occupied by boiler and forge work. The forge shop contains, besides a large equipment of light forges, a complete drop forge plant, a battery of bolt machines and heavy hammers, and forging presses up to 2,000 tons capacity. This whole shop is covered by an 80-ton bridge crane together with several smaller bridge and jib cranes.

Second in importance probably comes the machine work which includes a pattern shop, foundry and machine shop. Next in importance in the metal working trades are the sheet metal, pipe, boiler and copper shops.

Electricity, occupying as it does such an important part in modern men-of-war, has an ample representation in the activities of the yard. A modern battleship, for example, has generating capacity—aside from the main propulsion, which on some of the latest ships is electric—of nearly 1500 kilowatts.

Although woodwork is not used extensively aboard ship, every Navy Yard has a saw mill and joiner shop within its limits. The magnitude of this work can be judged by the fact that at Norfolk—one of the principal woodworking yards—a lumber storage of 90,000,000 board feet is maintained.

Many miscellaneous activities are required. A paint factory, wherein the Government manufactures its own paint to the extent of 700,000 gallons a year and 350,000 pounds of putty, is no small plant. In addition, the Navy does its own canvas, rigging and upholstering work, and at some of the yards makes clothing and flags.

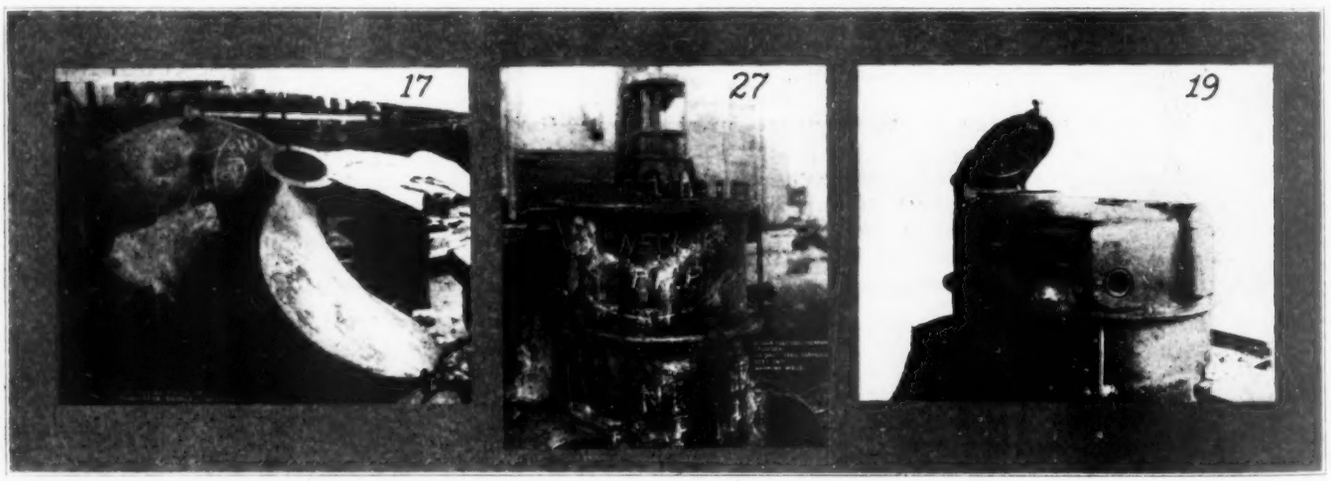
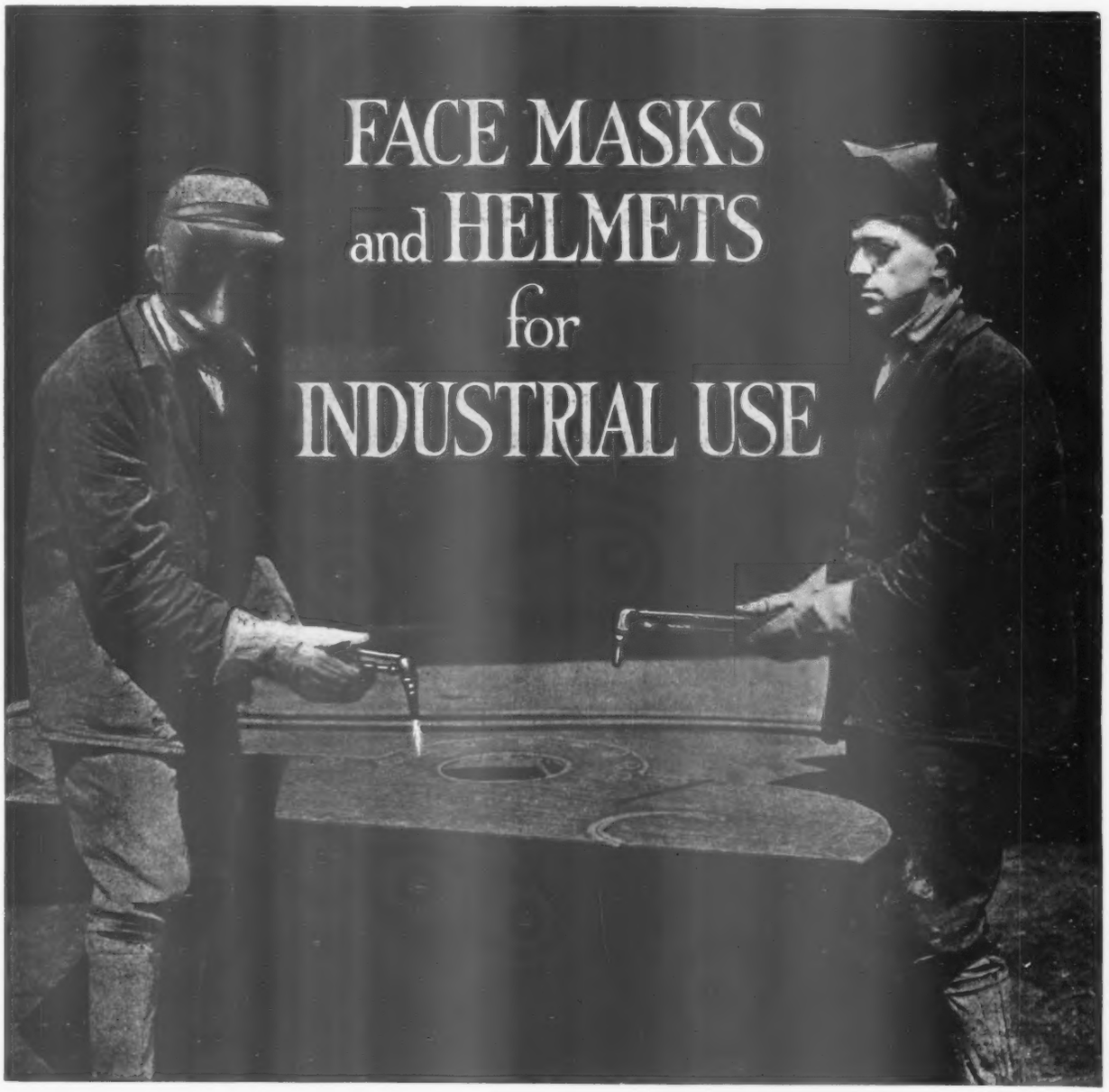


Figure 17—Filling Shrink Holes in a Manganese Bronze Propeller with the Aid of the Oxy-acetylene Blowpipe.

Figure 27—Port High Pressure Cylinder of the "Neckar" Showing Oxy-acetylene Welding.

Figure 19—Many Small Holes in Manganese Bronze Casting on Submarine Oxy-acetylene Welded. Casting Subjected to 88 Pounds Water Pressure.

Not only does the Navy manufacture practically all of its own boats at Navy Yards, but during the war undertook the manufacture of no less than 3,000 motor driven sailing launches for the Emergency Fleet Corporation. The Navy also manufactures all its gas engines, except high speed en-



A New Catalog, just issued. Send for it.

Makers of

Saniglas
TRADE MARK REGISTERED

Goggles for Every Eye Hazard

Julius King Optical Co.

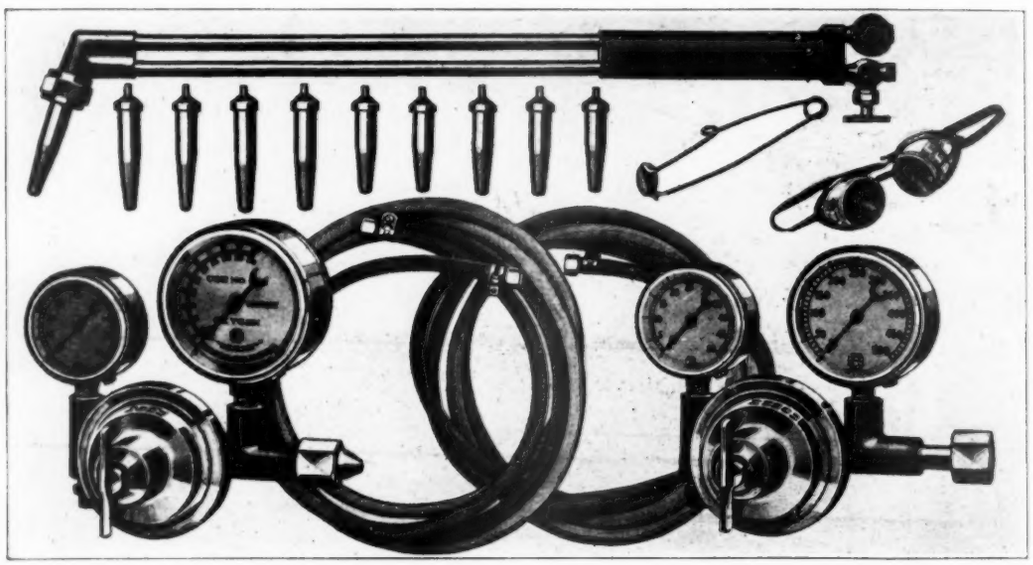
NEW YORK
10-12 Maiden Lane

CHICAGO
7 West Madison St.

REGO TRADE MARK

WELDING AND CU TI

REGO TORCHES, based on a brand new principle (U Pater *efficiency and economy. They won't back-fire.* y sa are strong claims. But Rego torches *make good.* O ee tri yourself they make good—in your own shop. If you nt mo Rego line, ask for our literature.



No. 5—Rego Welding Apparatus—$90

To Use With Dissolved Acetylene or Medium Pressure Generator For All Classes of Work.

Above outfit consists of:

1 Model "L" Welding Torch with 10 nickel copper tips

1 Oxygen Regulator with United States Gauges

1 Acetylene Regulator with United States Gauges

2 12½ ft. lengths best quality Hose

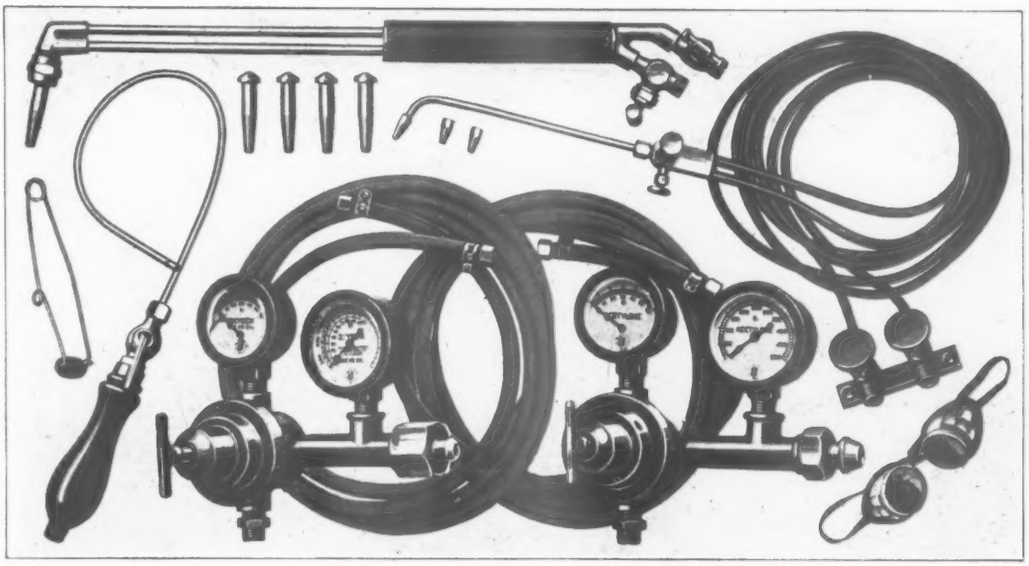
1 Pair Goggles—1 Ever-Ready Lighter—Clamps, Hose Connections, etc. complete.

THE BASTIAN BL S
WEST AUSTIN AVENUE A LA

TING APPARATUS

REGO TRADE MARK

Patent No. 1301044), develop remarkable qualities of
save oxygen. They make better welds. These
ee trial offer allows you to ***test them out***—to satisfy
t more information about the Rego principle, or the



No. 7—Rego Welding Apparatus—$65

Rego Auto Welding and Battery Service Outfit To Use With Oxygen and Acetylene.

Outfit consists of:

1 Model "S" Torch with 5 nickel copper tips
1 Oxygen Regulator with National Gauges
1 Acetylene Regulator with National Gauges
2 12½ ft. lengths hose—1 pair Glasses—1 Ever-Ready Lighter
1 Decarbonizing Torch—1 Lead Burning Torch with 3 tips
2 6 ft. Lengths Rubber Tubing—1 Bench Block—Clamps, Hose Connections, etc.

SSING COMPANY
LA SALLE STREET CHICAGO.

gines for speed boats; and during the war this activity produced about 250 engines a month.

From this brief statement it can readily be seen that Navy Yards are equipped to do practically any work—from the heaviest forging or casting, through all varieties of rough or delicate machining, down to the repair of delicate electrical and optical instruments, gyro compasses, clocks and watches.

Even yet we have not gotten to the uses of acetylene. In what follows I will tell you and illustrate a few of the many uses of acetylene. You will realize then, as I do now, that whatever we have accomplished to date, vast fields of future use await study and development.

To show that acetylene played an important part in Navy Yards in winning the war, the following monthly consumptions of acetylene at some of the Navy Yards are interesting:

Figure 18—New Tip Replaced on Manganese Bronze Propeller Plate by Means of Oxy-acetylene Process.

New York used about 110,000 cu. ft. per month; Charleston 15,000 cu. ft.; Norfolk 60,000 cu. ft.; Boston 75,000 cu. ft.

While one is apt to think of oxy-acetylene as a means of welding, it happens that in Navy Yards probably more acetylene is used in cutting than in welding. (Fig. 11) The war demanded of Navy Yards, working in many cases a 10 or 12-hour day, the reconstruction of hundreds of ships from the pursuits of peace to the transport of troops and the cargo carrying of war. Every time a passenger or cargo vessel is converted into a transport many changes are necessary. Bulkheads must be cut out or moved; ventilation must be installed; plumbing, berthing and messing fixtures must be manufactured and put in place. During the war, time was the primary consideration; money the secondary one. The acetylene torch cut its way through all obstructions and provided a quick and easily transportable means of accomplishing the desired end. Hundred of cutters were employed day and night. Ships were converted, refitted and quickly sent on their way, carrying the troops which at the vital moment perhaps turned the tide of war (Fig 13).

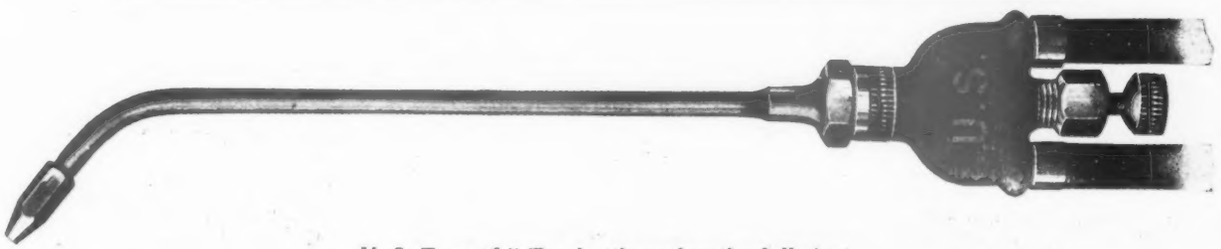
Not only were ships already in existence made over, but new construction in private yards, in new shipyards and in Navy Yards was rushed to the limit. Practically every plate and shape involved in ship construction, both merchant and man-of-war, requires cutting to a greater or less extent to ensure fitting, for passage of pipes, for access doors and hatches, etc. By the portability of the gas cutting torch the tool is taken to the work rather than the work brought to the tool.

In the field of armor cutting (and there are thousands of tons of armor in modern ships) the gas torch of course holds entire sway. Hydrogen here assists acetylene in the heavier cuts.

Many ingenious mechanical devices for guiding the torch have been developed, and, with these, a cut approaching in cleanness the cut of a power driven tool is obtainable. On account of the cleanness of cut (Fig. 14), the gas torch is of course always preferred to the carbon arc.

Not only were ships built during the war, but the Navy Yards were many times called upon for emergency repairs, often so extensive as to involve the rebuilding of an entire section of a ship. At New York the work on the Texas, Huntington, Olympia and Aeolus would have been many

ATTENTION!



U. S. Type "L" Torch (three-fourths full size).

This torch is designed for delicate welding operations where a very small concentrated heat is desired. It appeals especially to Light Sheet Metal Manufacturers; Job Welders, for fender welding and other light jobs; Garage and Battery Men for Lead Burning, Brazing and Radiator work. It has many applications, too numerous to mention.

Operates on Oxygen with low pressure Acetylene, City Gas, or any other fuel gas.

U. S. Type "L" Torch, with 3 Tips..... $5.00

(Weight 4 oz. Sent postpaid to any part of the world upon receipt of remittance.)

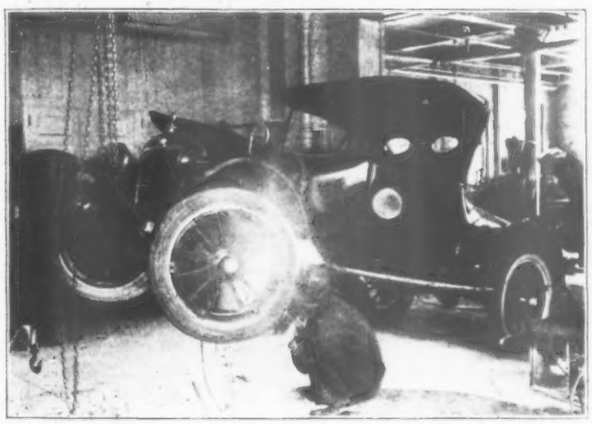
UNITED STATES WELDING CO., Inc.

Minneapolis, Minn., U. S. A.

EXCLUSIVE MANUFACTURERS OF

OXY-ACETYLENE **U.S.** EQUIPMENT

Welding Without Disassembling or Preheating



ARE YOU WELDING cracks in crank cases, cylinder blocks, frames and other parts without disassembling or preheating?

Our ALTERNATING CURRENT WELDER weld s up crank cases, frames, cylinder blocks,—in fact any break or crack that we can get at—without the heavy cost of disassembling or preheating.

The cost of the job with our machine is 1/6 to 1/10 of the cost of doing it with other apparatus.

With one of our machines in your shop you could make money on the automobile trade.

ELECTRODES, EXTRA FLEXIBLE CABLE, MASKS, GLASSES, HANDLES, etc., in stock.

Send for Catalogue No. 104!!

ELECTRIC ARC CUTTING AND WELDING COMPANY

222 Halsey Street, Newark, N. J.

weeks delayed without the gas torch. Boston did similar excellent work on the Mount Vernon, America and Covington, also in converting the Shawmut and Aroostook into mine layers. At Philadelphia the replacement of the whole

theless, acetylene is also extensively employed in this class of work. We feel, too, that the gas weld responds to annealing or other heat treating much better than does the arc weld.

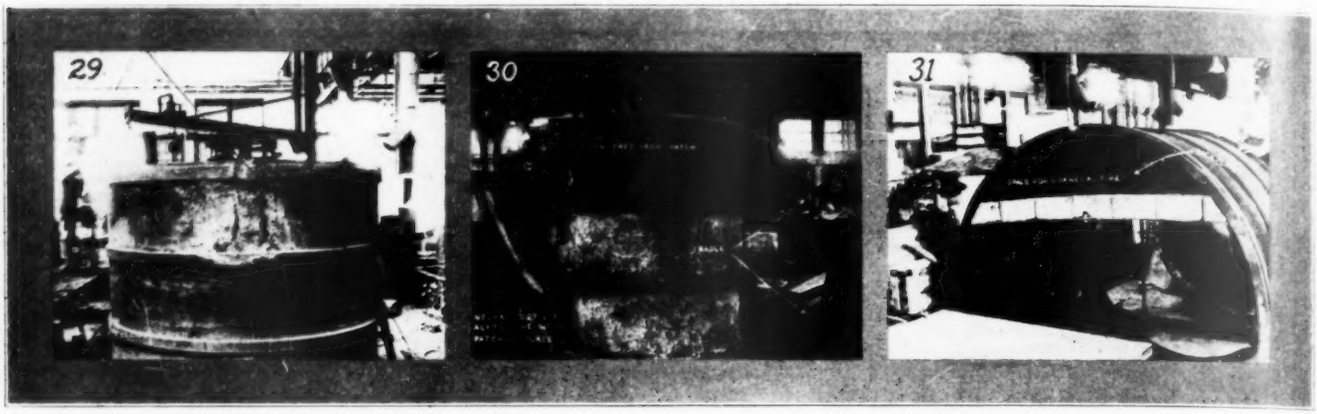


Figure 29—The Superior Machine Qualities of Oxy-acetylene Welded Metal Was Demonstrated by This Cylinder Liner.

Figure 30—Illustrating the Method of Applying Patches and Clamping the Damaged Cylinders in a Cradle (See Figure 32), Preparatory to Welding. "Neckar's" Starboard Second Intermediate Cylinder.

Figure 31—Showing the Arrangement for Preheating Liners and Cylinders.

forward end of a battleship which received the full impact of a mine explosion could never have been done in the required time in which it was accomplished without this fiery assistant. Boston had a like job on the torpedoed Mount Vernon.

Sea water is most unfriendly in its disposition towards steel. It therefore becomes necessary in ships to use non-corrodible metal in hundreds of places where steel or iron might otherwise be used. While the welding by electric arc of the non-ferrous alloys is undoubtedly possible and

Figure 14—Showing the Superiority of Oxy-acetylene Cutting Over Cutting by Carbon Arc.

When we come to the field of gas welding, Navy Yards do not differ, except in the variety of their work, from many of the other shops with which you are all familiar. Remember only that every metal working trade—and that repre-

may some day be extensively used, the use of the oxy-acetylene torch for this work up to the present has been practically universal. The welding of angle bars and in fact all of the shapes used in ship construction, heretofore done by

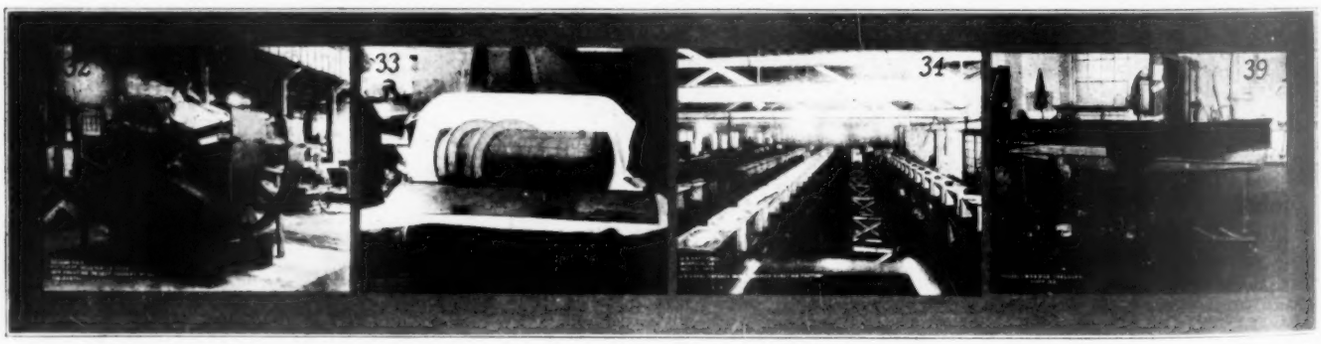


Figure 32—The Cradle Shown in Figure 30 Containing the "Neckar's" Starboard High Pressure Cylinder in Position for Oxy-Acetylene Welding.

Figure 33—Oxy-acetylene Welded Parts. (1) Gas Engine Fly-wheeling Guard. (2) Gasoline Tank. (3) Sound-proof Plate.

Figure 34—Mine Anchor Erecting Factory, Norfolk Navy Yard.

Figure 39—Typical Small Oxy-acetylene Welding Work.

sents nearly every metal trade in existence—at one time or another falls back on welding.

The electric arc has an important place in the welding of structural steel and steel castings and forgings, but, never-

the blacksmith, is rapidly being taken over by the gas or arc welder; and fittings built up out of scraps of plates, shapes, pipes, etc., are everywhere in evidence. The cost of the gas

(Continued on Page 46)

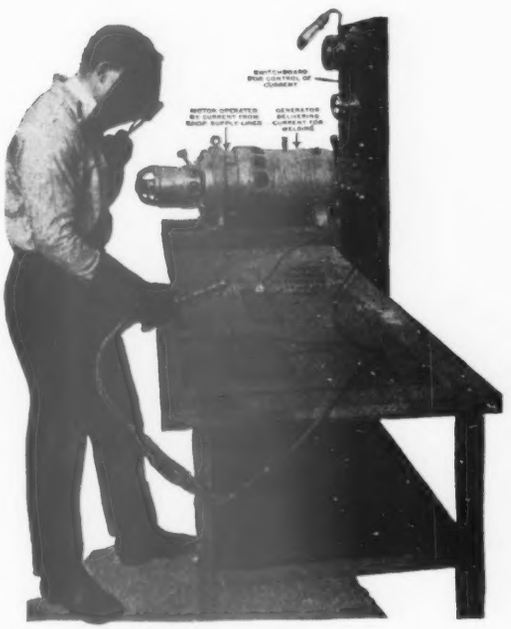
LINCOLN ARC WELDER

Simple and Practical

You can see for yourself how simple and rugged a Lincoln Arc Welder is

The Lincoln Arc Welder is a piece of electrical apparatus which your maintenance man understands, and can keep in order just as easily as he does the rest of your shop equipment.

There is a motor—just the same kind as the rest of the motors around the plant—which is direct-connected to a generator which provides the right kind of current for welding. That's all the working parts there are to it, except for the control board mounting—three simple knife switches and the meters which tell you just what the welder is doing. The stabilizer which steadies the arc while welding has no moving parts at all.



Ask for Bulletin 101-W, about the simple Lincoln Arc Welder—the welder that anyone in your plant can understand.

This Lincoln Motor operated over 3 years under water without damage.

The Lincoln Electric Co.

Cleveland, Ohio

New York City, Buffalo, Syracuse, Cincinnati, Chicago, Detroit, Columbus, Pittsburgh, Philadelphia, Boston, Charlotte, N. C., Minneapolis, Baltimore, San Francisco

The Lincoln Electric Co. of Canada, Ltd., Toronto-Montreal
Agencies in other principal cities

The Welding Engineer

Reg. U. S. Pat. Office.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,

608 S. Dearborn St., Chicago, Ill.

Telephone Wabash 7134.

L. B. Mackenzie.....President and Editor

Subscription payable in advance and postage free.

United States, Canada and Mexico.....$2.00 a year

Foreign Countries..... 3.00 a year

Single copy, domestic .....20 cents

Single copy, foreign .....25 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations.

Eastern Office:

171 Madison Ave., New York. Telephone, Murray Hill 4894.

Max I. Barth, Eastern Representative.

The Welding Engineer in Australia and New Zealand.

Mr. R. Hill, Matlock House, Devonport, Auckland, New Zealand, is our accredited representative in Australia and New Zealand for obtaining new subscriptions.

VOLUME 4. OCTOBER, 1919. NUMBER 10.

Automatic Welding and Cutting Machines.

GREAT progress has been made during the past two years in the field of automatic welding and cutting machines. The demand for production and speed was largely responsible for this. No doubt the next two years will see further progress in this direction. A noted French contemporary deplores the fact that the war prevented the development of automatic machines in France and the statement is made that hand welding is still employed in construction operations where machines should be in use. A recent issue of Revue de la Soudure Autogene, Paris, says:

"The increasing demands by labor for higher wages is directing attention anew to the possibilities of automatic welding by means of machinery. In mechanics nothing is impossible and automatic welding will replace to a great extent hand welding in construction operations. It is regretted that hand welding, with all it's uncertainty, is still employed on certain operations that could be better performed by a machine. The war has naturally interfered with a great deal of steps towards progress that were in contemplation, but it is safe to say that the subject, because of its increasing importance, will be studied and the problem solved."

No doubt many welding operations are being performed by the hand method which might be more profitably performed by an automatic machine, and no doubt this is especially true of France, where industrial development suffered so much, but we do not believe it is quite accurate to refer to the hand method as being "uncertain." On the contrary we demonstrated in this country during the war that unskilled men and women could be developed into welders in a short space of time, so far as light construction work was concerned. If a welding operation is performed properly there is very little uncertainty about the results. There is more uncertainty about the selection of the welder. There are good, bad and indifferent welders and many failures result from allowing inexperienced welders to experiment with jobs about which they know little or nothing.

The Welding Specialist

THE welding specialist must not only know all about the subject of welding, but he must also have a good working knowledge of other branches of mechanics as well. It is not difficult to find a very good welder, one who turns out very good work. It is more difficult, however, to find a good welder who, after he has turned out a perfect piece of work, can explain exactly why his work is good. He is long on practice and short on theory. The man who seeks to become a welding specialist should neglect no opportunity to study. Constant study and experimental work will make any good welder a better welder.

WELDING BELLS

The bell shown in this illustration is a fair sample of the work done at the Norfolk Navy Yard, and is shown here because of a number of inquiries received by *The Welding Engineer* recently on the subject of bells. In speaking of welding bells Commander H. G. Knox, who's paper appears elsewhere in this issue, says:

"The approximate size of the ships' bells we have heretofore welded is a height and diameter of 14 inches and a weight of 250 to 300 pounds. While it is endeavored to have these bells of uniform tone, they are of course not tuned, and generally no machine work is performed on them. The tone after welding is sufficiently pure for our purposes. Inasmuch as the bells never work together their relative tone is not compared. Judging from some of the ships' bells I have heard in service I should say that a 'sour' bell is not unusual. We use a bell metal filler rod for welding bells. The rods are cast in our own foundry. The work is done by oxy-acetylene. In fact, we seldom if ever use the electric arc on nonferrous alloys; this is not because we feel that the electric arc may not be suitable but because we have never developed it for this work, and the low melting point of the nonferrous alloys when used as electrodes renders the making of good arc welds difficult."

Welded Ship's Bell.

Prest-O-Lite

Buffalo, N. Y.—A new Prest-O-Lite charging plant.

Convenient Producing Plants

The Backbone of Prest-O-Lite Service

NATION-WIDE Prest-O-Lite Service brings straight to the user's hands a single cylinder of highest-temperature gas—or hundreds of cylinders—

Such a Service must have a backbone strong enough to carry the tremendous load of national demand, flexible enough to meet the ever-changing needs of any one of an army of users.

40 Plants and Warehouses Supply

Prest-O-Lite

DISSOLVED ACETYLENE

Wherever you may be located, however large or small your requirements, there is an efficient Prest-O-Lite *producing* plant near—ready to serve you quickly and well.

THE PREST-O-LITE COMPANY, Inc., General Offices 30 East 42nd Street, New York
Kohl Building, San Francisco
In Canada—Prest-O-Lite Co. of Canada, Limited, Toronto

131

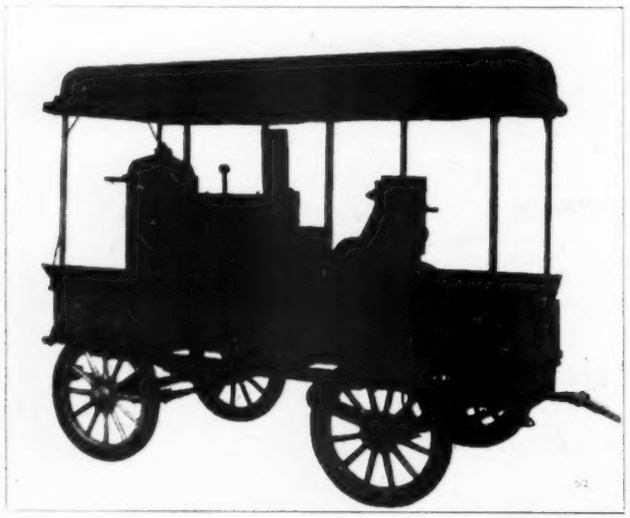
ARC WELDING *for the* COMMERCIAL WELDING SHOPS

By Robert E. Kinkead*

Commercial welding men as a whole do not realize the possibilities of profit which may be brought about by the use of electric arc welding equipment.

When the job shop man thinks of electric arc welding, as a rule, he thinks of it as a substitute for gas welding on the work he is doing rather than as a different process which in general serves as a different field of operations. This, unfortunately, though quite naturally, gives him an indifferent attitude towards the process.

A job welding shop needs gas equipment for a large part of the work done at present in the shop, particularly on cast iron, brass and aluminum jobs. Certain thin sheet steel jobs are done far more easily and certainly as cheaply with gas as with the electric arc.



Gasoline Driven Unit on 1½-Ton Trailer Truck.

So long as the welding man maintains the attitude that the electric process is merely a poor competition of the gas on work of this nature, and does not look at what the electric arc **can** do to make him profit, he has stopped progressing and that in turn means that his star is beginning to set.

What can the electric arc do that the gas can't do at the same cost?

1—Steel welding from 3-16 inch thickness up. The sky is the limit on thickness.
2—Boiler repair welding.
3—Certain classes of cast iron welding without pre-heating.
4—Welding in place of caulking on riveted seams.
5—Welding flues.
6—Building up on worn steel castings, shafts, axles, etc.
7—Street railway track repairs.
8—Ship repairs.
9—Automobile frame repairs and alterations.
10—Thawing water pipes.

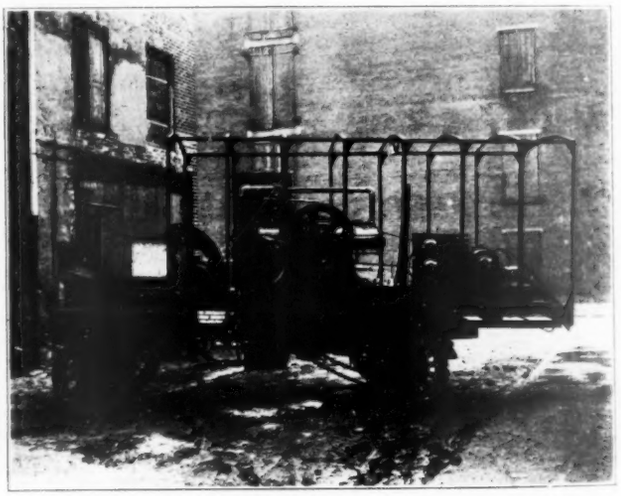
So long as the job welder confines himself to the class of work which can be profitably done with gas, that long he limits his field of operations to such an extent that his business can never become more than a "hole in the wall" repair shop.

There are thousands of such shops throughout the country run by men of broad experience, but narrow vision. There is room for enormous expansion for the job welder with vision and nerve to act. There are probably twenty job welders in the country who are really "covering" their field of operations and getting the work they ought to get with both gas and electric processes.

The average job welder thinks in terms of welding rather than in terms that get business. The job welder is somewhat like a good old family doctor; he knows his job and has lots of common sense, but he don't go out and get the business.

The job welder, besides his gas equipment, needs two kinds of electric arc welding apparatus—motor driven shop equipment and gasolene engine driven portable equipment. The motor driven shop equipment allows him to do steel welding at a price that enables him to enter the field of manufacturing welding. The really profitable job shop does some manufacturing welding to keep men and equipment busy all the time. Manufacturing welding with gas equipment is too expensive to permit the job welder getting much work.

Whenever work can be brought into the shop to the arc welder at a lower cost than the portable welder can be taken to the job, it is obvious that the work should be brought in. Repairs to light plant machinery such as the customer is glad to bring to the welding shop to save time, can be done with the arc welder when the job is of such a nature as to be adaptable to arc welding. When the arc welder can be used, it results in greater profit to the shop.



Typical Job Welders Portable Outfit on Truck (Cover Removed).

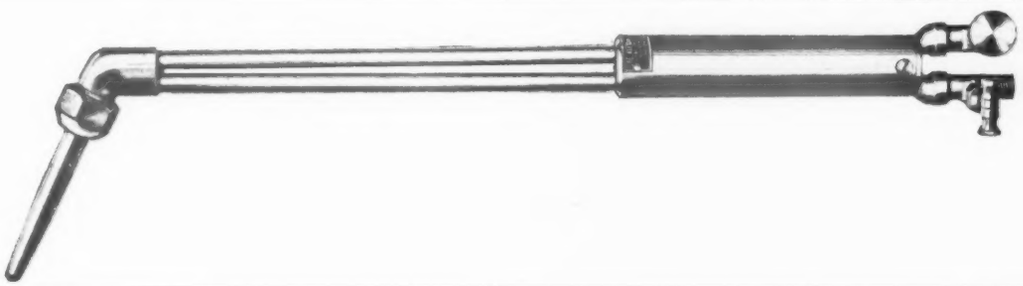
On the outside the electric welding generator must be driven by its own prime mover. The gasolene engine is the best solution. An electric power supply is not always readily available, and even when available, may be of different voltage, or may be direct or alternating current so that it is not suitable for the shop machine, even if it were moved out on the job.

The engine driven unit is entirely independent of electric power lines.

The sources of business for the portable electric welder are dependent upon the locality, of course, but a partial list of places where work has been obtained is given below:

*Lincoln Electric Co.

The Milburn Quick-Weld Torch is the most efficient and economical torch on the market today because it welds on equal pressures of oxygen and acetylene.



THE elimination of all danger of oxydizing the metal that comes with the use of the Quick-Weld torch is hardly more important than the economy due to the use of equal pressures. The Quick-Weld, Type J Torch saves great quantities of oxygen—which is the expensive part of any welding job. On heavy work the amount of oxygen used is much less than that required by the ordinary torch. Consider this tremendous saving during the period of a year! You positively can't afford to do without the Milburn Quick-Weld Type J. We will send you one on approval if you say so, or write for booklet No. 37 which describes it in detail.

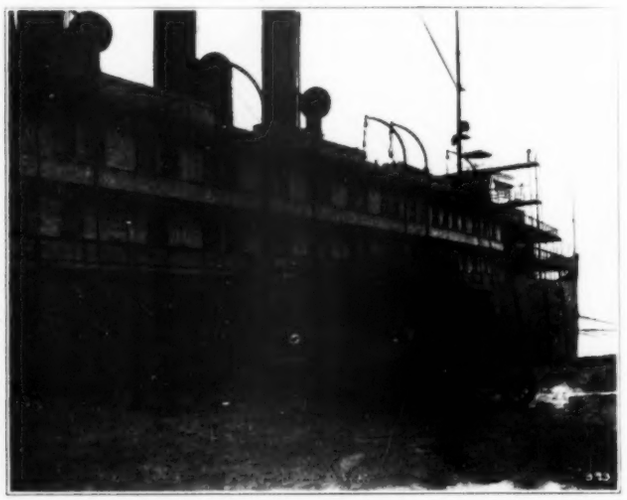
Milburn Acetylene Lights are standard for construction, mining, railway or shop. Write for booklet No. 27.

Milburn welding and cutting torches are covered by U. S. patents and the Alexander Milburn Company guarantees full protection to vendors and users of its products.

THE ALEXANDER MILBURN COMPANY - BALTIMORE, MD

New York 51 E. 42nd St.
Chicago 1012 Kimball Bldg.
Pittsburgh 406 Bessemer Bldg.
San Francisco 1037 Monadnock Bldg.
Philadelphia Distributor: M. K. Epstein, Lincoln Bldg.
Agencies throughout the United States and Canada.

Steel Mills
Cement Plants
Shipyards
Ships
Chemical Plants
Textile Mills
Gas Works
Water Works
Large and Small Power Plants
Small Steam Boiler Installations
Rubber Plants
Street Railway Shops
Street Railway Track Maintenance Department



Typical Job Welders Portable Outfit Mounted on Heavy Truck.

Oil Refineries
Automobile Plants
Paper Mills

In order to get business for a portable electric welding outfit, prospective customers must be educated in the use of the process and what it will do for them. The reason so little work is being done now as compared with what might be done is that the people who have work to be done do not know what the process will do for them. One job welder keeps a photographic record of all of the jobs he does. This is his business getter. He gets more business than all of his competitors combined because he goes at it in the right way and has a record of successful performance to show.

The owner of a job welding shop who does welding himself is a mighty poor business man. The mere fact that he is the owner of the shop is good evidence that he has more business ability than any of his employees. The owner of the shop ought to be out getting the business, or if it is a large institution, at least closely supervising the getting of the business. The class of business obtained and the price set on the work determines whether the owner makes or loses money. This is one of the big reasons most of the job shop men are "just making a living." They are playing with the welding when they ought to be getting out getting work.

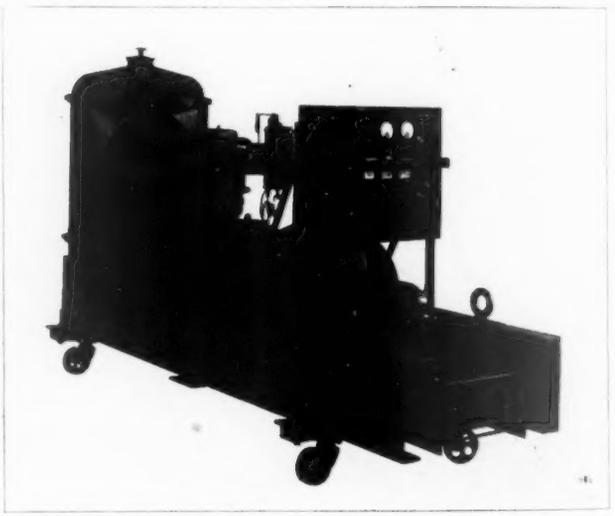
Electric arc welding is not as hard for the operator to do as gas welding. It takes just as long to learn welding with the electric arc as with the gas, but once the operator has learned welding, he will experience little difficulty in changing from one process to the other. The manipulation of the arc or the gas torch is a very small part of the craft of welding. And incidentally, no electric machine has been produced so far that in any way reduces the necessity of experience and common sense in welding practice. An intelligent and experienced gas operator will handle the electric process as well as he can the gas with three or four weeks working experience.

A portable electric welding outfit costs from $2,000 to $4,000, depending on truck used, whether or not air compressor is bought, etc. Starting from the ground up, assume that the completed outfit costs $4,000. As a general proposition, an operator and helper can be sent anywhere within a radius of 75 miles with the equipment.

Assuming that a high class operator is employed and paid full time whether he works on productive work or not, the actual labor cost for a year, including helper, will not exceed $4,200. Another $2,100 should be added for overhead expense. Supplies, including gasoline, welding wire and maintenance should be figured at a cost of $1,200. Thus we have:

Portable welder	$4,000.00
Labor	4,200.00
Overhead	2,100.00
Supplies, etc.	1,200.00
	$11,500.00

At the lowest prevailing rate at which this class of welding is done, if the equipment were operated on productive work 6 hours per day, 300 days during the year, it would pay for itself and yield a profit of roughly $3,000 to the shop. A fair average gross income from a portable outfit for a year's operation is $15,000.



Gasoline Engine Driven Unit—Portable Type.

The real profit comes to the man who is a hustler and has a vision enough to develop new jobs and who can keep his equipment in operation 12 hours or even 18 hours per day the year around. There are many portable electric welding outfits which have averaged more than 12 hours per day for over two years.

Let no one be misled into beliveing that the mere possession of electric welding equipment means that handsome profits will be realized. But electric arc welding equipment has meant excellent profits to hustling wide awake job shop owners who know how to get business. There is room for enormous expansion. We of the equipment manufacturing end are preparing to furnish at least five times as much equipment in the next two years as we have furnished in the last two years.

LOOK OUT

for

1. **Efficiency in operation**
2. **Cost of operation**
3. **Speed in welding**
4. **Degree of certainty of uninterrupted service.**

Primary requisites of welding apparatus and you have the

"ZEUS"

then add LOW INITIAL COST.

Is this suggestion worth only the time it takes to read it or are you interested in details?

EXCLUSIVE TERRITORY is now being apportioned. We have given preference to the wide awake dealers of gas apparatus who have seen the arc as the inevitable master of the welding field, because acquaintance in the field plus the knowledge of the arc as the "ultimate welding medium" assures orders. We do not, however, limit ourselves in this regard.

GIBB INSTRUMENT COMPANY

Office and Factory, 348 Palmer Ave., East, Detroit, Mich.

ACETYLENE IN NAVY YARDS

(Continued from Page 38)

welded article is very much less than when made by the smith. The entire drainage system, including most of the fittings of the three destroyers now being completed at Norfolk, were made by welding scraps of steel together, thereby eliminating castings. The welding of pipe (Fig. 16) and pipe fittings offers a wide field for ingenuity. Flanged elbows may be made by filling steel tubing with sand and making four close right-angle bends. When cut apart scrap steel flanges are welded on to complete the elbows. Tees, crosses, deck and bulkhead fittings are likewise readily made up.

The brasses and bronzes used in such a variety of mixtures aboard ship (Fig. 17) are all more successfully welded

Figure 13—A Section Cut from a 12-inch Steel Billet.

or built up with the oxy-acetylene torch than by any other method. One of the most frequent callers for repairs are propellers. (Fig. 18) New tips, new edges, and in some cases practically entire blades, are recast from manganese bronze and welded on successfully. Fittings for submarines (Fig. 19) also come in for their share of welding, and these must not only be strong but tight. Portsmouth, N. H., specializes in submarine construction, and frequently has to weld large manganese bronze castings for these undersea craft. Bell metal (Fig. 20) also occasionally fails but the breaks are easily gas welded.

In addition to manganese bronze and bell metal, we also nal bronze, naval brass, muntz metal, phosphor bronze, and last, but not least, pure copper. Under intelligent operation the gas welding of copper may some day almost completely supplant the coppersmith's art of brazing. Naval rolled brass encounter in large quantities gun metal, valve bronze, journ- is the favorite filling material for copper and most of the other brasses and bronzes. Samples of copper pipe made up out of 5-16-inch sheet copper have been hydrostatically tested to destruction, and the welded seams compared very favorably with braized seams.

Cast iron is also welded more reliably with oxy-acetylene than with the electric arc.

There are times when, due to the complexity of a casting, the arc rather than gas may be more conveniently used. The use of carbon blocks and carbon paste of course greatly extends the field of the gas torch in difficult jobs, and these aids are freely used.

The pre-heating of a complicated iron casting is often not permissible, and a "cold" weld is more common with the arc than with gas. Gas however more than holds its own in the special field of cast iron.

Much has been said about the salvaging of the main engine cylinders of the German ships at various Navy Yards particularly the New York Navy Yard. The repairs to engines effected by welding on these ships undoubtedly is one of the most spectacular feats of the war. At New York all of the welds were made with the electric arc, as were a few at Philadelphia, Boston and Norfolk. As far as I am aware all of the welds made on these cylinders have stood up perfectly in service.

At Norfolk three German ships were delivered for repair—the Rhein, Neckar and Bulgaria. The major portion of the welds on the damaged cylinders of these ships were made by oxy-acetylene. The only bad break on the Bulgaria was

ELECTROLYTIC GASES

Firms affiliated in the Gas Products Association manufacture oxygen and hydrogen produced from the electrical decomposition of distilled water. This process yields gases of unexcelled purity and highest efficiency for cutting or welding operations. Electrolytic gases are wholly free from inert impurities. The purchasers of electrolytic gases take no chances. As applied to oxygen and hydrogen electrolytic means purity.

Pick your nearest service station. Any quantity available.

Get Electrolytic Oxygen and Hydrogen

Obtainable at the Following Service Stations:

CALIFORNIA
California Burdott Oxygen Co., Los Angeles
California Burdott Oxygen Co., Oakland

COLORADO
Burdett Oxygen Co., Denver

ILLINOIS
National Oxygen Co., Chicago
Acme Oxygen Co., Chicago
Burdett Oxygen & Hydrogen Co., Chicago
Electrox Co., Peoria
Swift & Co., Chicago

INDIANA
Indiana Oxygen Co., Indianapolis
Logansport Oxygen Co., Logansport

IOWA
Bettendorf Oxygen Hydrogen Co., Bettendorf

KENTUCKY
Kentucky Oxygen & Hydrogen Co., Louisville

MICHIGAN
Michigan Ox-Hydric Co., Muskegon
National Oxygen Co., Detroit
Burdett Oxygen Co. of Detroit, Detroit

MINNESOTA
Commercial Gas Co., Minneapolis

MISSOURI
Oxygen Gas Co., Kansas City (two plants in Kansas City)
St. Louis Oxygen Co., St. Louis

MONTANA
Mountaineer Welders Supply Co., Butte

NEBRASKA
The Balbach Company, Omaha

NEW YORK
Standard Oxygen Co., New York City
International Oxygen Co., College Point, L. I.

NEW JERSEY
International Oxygen Co., Newark
Standard Oxygen Co., Hoboken

OHIO
Burdett Oxygen Co. of Cleveland, Cleveland
Ohio Chemical & Mfg. Co., Cleveland
Dayton Oxygen & Hydrogen Products Co., Dayton
Ohio Electrolytic Oxygen Co., Cincinnati
Clarke Chemical Co., Wickliffe

OKLAHOMA
Burdett Oxygen Co. of Oklahoma, Oklahoma City

OREGON
Portland Oxygen & Hydrogen Co., Portland

PENNSYLVANIA
International Oxygen Co., Verona
Burdett Oxygen Co., Philadelphia (Plants at Chester & Norristown)
Burdett Oxygen & Hydrogen Co., Pittsburgh
National Oxygen Co., Erie

TENNESSEE
Burdett Oxygen Co., Chattanooga

TEXAS
Burdett Oxygen Co. of Texas, Ft. Worth
Magnolia Gas Products Co., Houston

UTAH
Whitmore Oxygen Co., Salt Lake City
Utah Burdett Oxygen Co., Salt Lake City

WASHINGTON
Washington Burdett Oxygen Co., Seattle

WISCONSIN
Universal Oxygen Co., Sheboygan

BRITISH COLUMBIA
Compressed Gas Co., Ltd., Vancouver

GAS PRODUCTS ASSOCIATION

801 Marquette Bldg., Chicago, Ill.

repaired by electric arc. On the Rhein and Neckar, however, all of the major welds were made with gas. Six of the Rhein's eight cylinders were gas welded. Six of the Neckar's eight cylinders were also gas welded. (Figs. 27 and 30.)

One important point in comparing gas and arc welds in cast iron that was brought out by the big cylinder job is the superior machining of the gas weld. A welded cylinder liner (Fig. 29), for example, machined with no trace of hardness at the cleavage line between parent metal and filler. This was seldom the case with the arc welds where machining was required.

Excepting for the size of the welds and the importance of the jobs, no special features of interest developed in the welding. Patches were made of cast iron (Fig. 30) and the patch and cylinder after clamping together were preheated with charcoal fires (Fig. 31) for several hours before welding started. In order that the puddled metal of the weld might be kept horizontal, and thereby facilitate the welding, the cylinders were carried in cradles or rockers (Fig. 32) so that they could be rotated.

While ship work represents the principle activity of the Navy Yard, yet most of the Navy Yards carry on considerable strictly manufacturing work. A few of the yards have developed specialties in many fields.

At Norfolk, for example, no less than 26,500 rectangular pipe bunks for transports were welded during the war. 9,000 gasoline tanks (Figs. 33) for motor boats were also turned out during the same period. The longitudinal seams of these tanks were mechanically welded on a "barrel welder." Norfolk also manufactured over 200,000 packing boxes for the Bureau of Ordnance. These airtight boxes are used for the transportation of smokeless powder from the factories where the charges are made up. The handles were welded to the tops of these boxs by oxy-acetylene on a piece-work basis.

The biggest single war-time job of a manufacturing nature undertaken at Norfolk was the manufacture of nearly 15,000 naval defense mines. (Fig. 34) Except for certain minor castings and assemblies, the work was done entirely at the Navy Yard. A large double acting drawing press more than paid for itself on this job alone. Each of these mine spheres involves a 10-foot gas weld at the equator seam. 10 to 20 men were employed continuously on this work. The anchor of the mine is in reality a complicated piece of mechanism requiring systematic assembly.

A use for acetylene in Navy Yards, which is out of the ordinary, is its availability for the local heating of structural plates and other members, particularly when damaged by collision. It is often necessary to straighten plates or remove bumps, and the quick local heating of such work is done, although perhaps not economically, by acetylene. During the war many vessels were fitted with underwater mine sweeping devices, and the shaping and bending of plates by acetylene for this work was quite common.

One more use for acetylene may be mentioned, although it is not general; this is lighting. Some of the Navy Yards during the war on more than one occasion fell back upon portable acetylene lighting equipments for their emergency work in the bottom of dry docks or other places where electric flood lamps could not readily be installed.

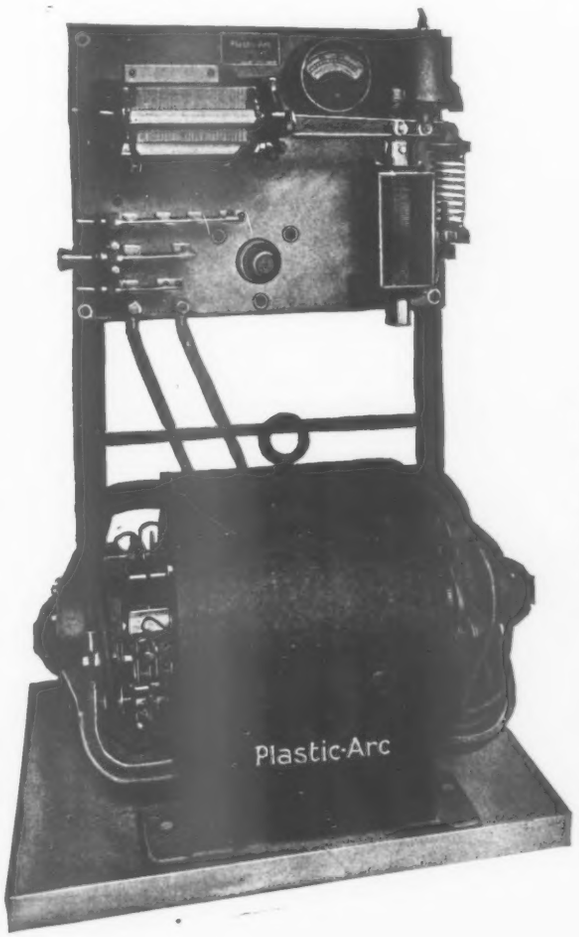
While not part of the Navy Yard's activities, several of the Navy Yards actually supply the Lighthouse Department with most of the gas used in the thousands of gas lighted

Figure 40—A Steam Warming Table Made by Oxy-acetylene Welding at the Norfolk Navy Yard.

NEW Plastic-Arc UNIT

The ideal outfit for every welding shop

The Plastic-Arc System requires no preheating of any job, whether large or small.



This Plastic-Arc Outfit delivers constant heat at the weld regardless of the skill of the operator.

This outfit operates on the well known Wilson principles of constant voltage of 35 and an automatically regulated current, insuring a constant critical heat at the weld.

Practically any metal including cast-iron or steel, boiler plate, copper, brass, aluminum, etc. can be welded with this outfit, **without preheating.**

Three switches on the panel provide an easy means of current adjustment, between 25 and 175 amperes, insuring a proper heat at the weld to suit the fusing point of the particular metal to be welded.

This outfit can be furnished as a motor driven unit, with a motor of practically any characteristics to suit the local source of power supply; also as a gasoline-driven unit, or it can be furnished without a motor, to be driven by any means available.

The normal generator speed is 1800 R. P. M. The weight of this new outfit is 807 lbs. with A. C. motor, 800 with D. C. motor, 1200 with gasoline engine, and 550 lbs., as a belted outfit without motor. These new sets can be furnished as portable outfits if desired.

Write for further details and a copy of our new Manual-Catalog No. 4.

Wilson Welder & Metals Co., Inc.
2 Rector Street, New York

buoys which mark the water highways of our coasts. These gas buoys have reached a remarkable state of reliability, and acetylene is practically the only illuminant now used.

Most of the Navy Yards are equipped with their own gas generating plants. Few of the yards are, however, self-supporting, and they are therefore dependent on outside concerns for making up the deficiency.

Immediately after an unfortunate accident in the gas generating plant at Norfolk in May of this year, I had the privilege of visiting two or three of the largest gas plants in the country, and as a result have prepared a type plan of gas generating plant for Navy Yard use. (Fig. 38) After modification in Washington and approval, it is probable this plan will be adopted for the Navy Yard gas plants built in the future.

removed from ships for repair. The welding shop furnishes trained men to other shops on permanent or temporary details, often in large numbers. By concentrating the work in one shop under a single foreman, we are able to much better control the technique of welding and at the same time accomplish the maximum of work with the minimum force.

The equipment of this shop includes a complete gas cutting and welding outfit, as well as fixed and portable arc welding equipment. This shop furnishes all the electrode and filling material, protective devices, and in fact all of the adjuncts necessary to welding.

In the increase of the welding activities it became impossible during the war to obtain trained welders. We therefore undertook the training of our own men, and the school now established, which works in connection with the welding

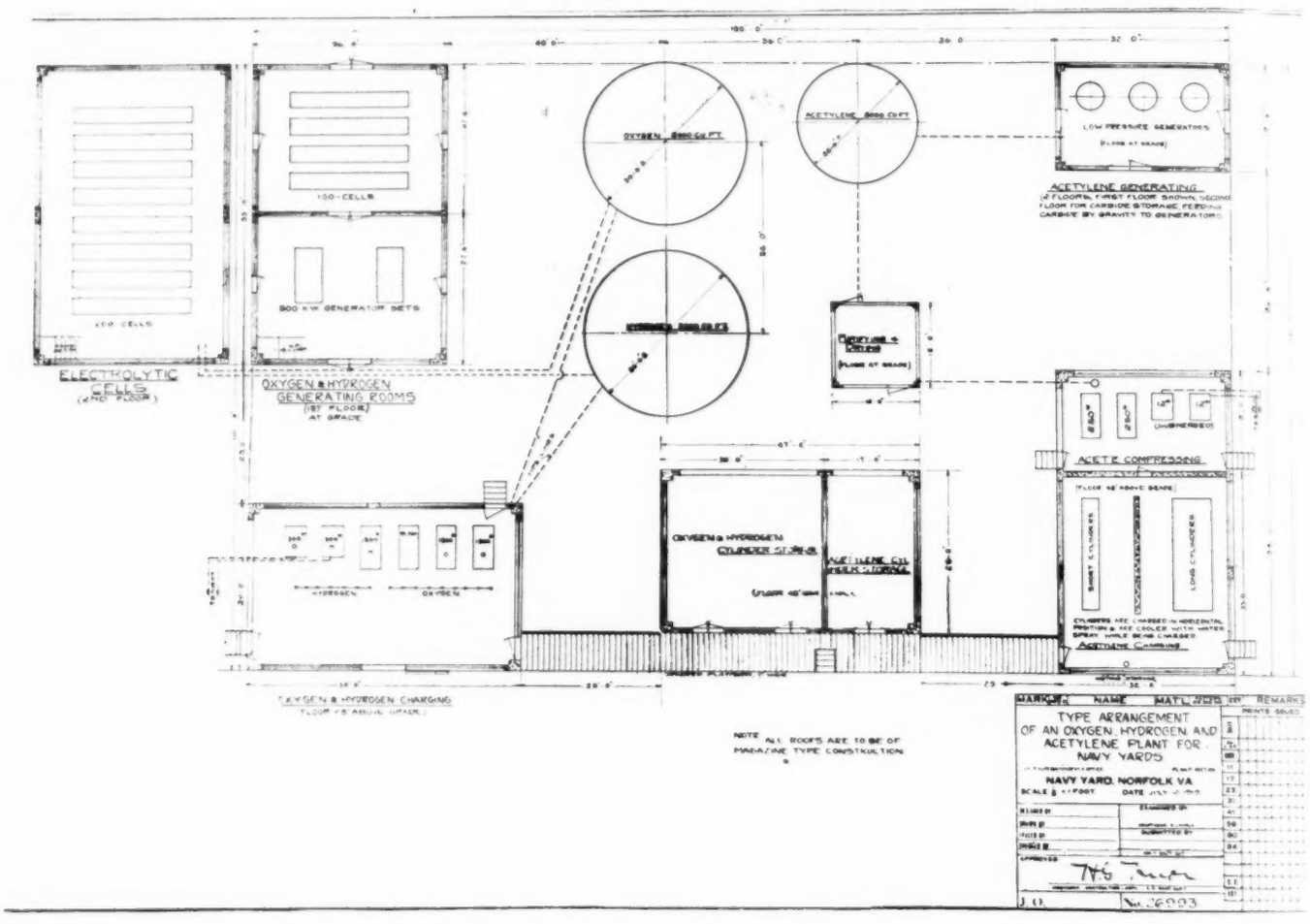

ELECTROLYTIC CELLS
OXYGEN & HYDROGEN GENERATING ROOMS
ACETYLENE GENERATING
ACETYLENE COMPRESSING
TYPE ARRANGEMENT OF AN OXYGEN, HYDROGEN AND ACETYLENE PLANT FOR NAVY YARDS
NAVY YARD, NORFOLK VA

Figure 38—Typical Plan of an Oxygen, Hydrogen and Acetylene Generating Plant, for Navy Yards.

In this layout an attempt was made to separate the various gases, and in case of acetylene the various stages of production, from generation to storage of gas in tanks. This plan also contemplates the piping of acetylene at about 12 pounds pressure to all the shops in the vicinity of the centrally located gas plant. In this way the high pressure compression of much gas can be avoided as well as the transportation of gas tanks. This method has already proved very efficient in many yards. Oxygen and hydrogen are likewise piped to manifolds at convenient points on the shop walls.

An innovation recently started at the Norfolk Yard is the establishment of a welding shop. This does not mean that the welding shop will control or perform all welding work, (Fig. 39) but it will be the headquarters for welding and cutting equipment and trained operators. This shop will, however, do all the job welding on castings and other work

shop at the Norfolk Yard, not only supplies our trained operators, but is also the central training point for operators from the other east coast Navy Yards. By giving students not only practical work but lectures in the properties of metals, the expansions and contractions encountered in welding, and kindred subjects, we endeavor to turn out students who, after they have spent a few months in practical work outside, can at any time be called upon to face the variety of problems which are, with us, an everyday occurrence.

As stated at the outset, I have dwelt more perhaps on the general activities of Navy Yard than on the uses of acetylene within the Yard. It would be impossible to detail the activities of our indispensable ally-acetylene, nor in the scope of one short paper could one even begin to give an idea of the part it played directly and indirectly in winning the war with Germany.

THE NEW AIRCO WELDING TORCH.

A new welding torch, capable of meeting the varied requirements, has been announced by the Air Reduction Sales Co., manufacturers of Airco welding and cutting gases and apparatus.

The announcement of the new torch emphasizes the importance of the oxy-acetylene blowpipe now as compared with a few years back. Then the work the welder was called upon to do was limited, and as long as the torch produced a flame that would weld the metals, he was not forced to concern himself as to how much gas was used, how much wasted, or whether or not the weld was the best that could be made.

Now, however, all this is changed. The welding torch is all important. The numerous new uses for the apparatus that have been discovered in the metal field have necessitated the employment of a highly efficient tool. As a result the modern welder is careful to get the best apparatus possible and when he does get such equipment takes proper pride in its accomplishments.

In the new Airco torch, the manufacturers have aimed to produce apparatus that would meet the requirements of the practical welder based on his experience with other equipment. Improvements have been made not only in fundamental design, but in such details as the nicety of construction of the valve handles, hose connections, etc.

To insure none but desirable features being incorporated only those principles were followed which had been proven correct and in full accord with the requirements of practical usage. The Airco welding torch is of very strong construction, yet at the same time is so light and well balanced that the operator will not experience the usual strain when welding a long job. The handle is knurled and comfortably proportioned so that a firm grip can be secured without undue pressure. An interesting feature in this connection is a gas pressure table rolled on the upper part of the handle. Such a table is very handy for reference and this location proves a convenient and lasting place for the information.

The valve handles are of octagon shape. They are easily turned and will not catch in the operator's work or clothing. Both the handles are on the left side. With this construction and with the hose connections extending straight out from the valve body, there is nothing to interfere with the proper manipulation of the torch.

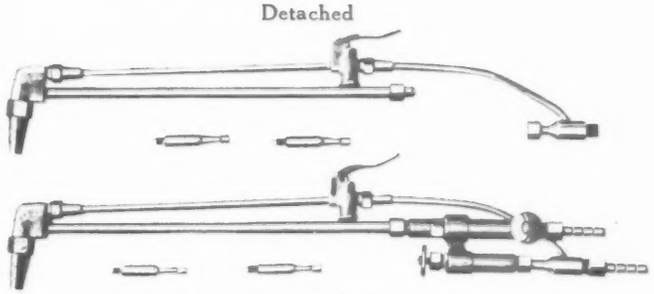
All passages are so designed and the parts so assembled as to insure an easy flow of gas. The tubes between the head and handle are of hard drawn seamless brass, countersunk at both ends. The torch is silver soldered. The valve body and the butt of the handle are in one casting instead of being screwed together. The valve body will not work loose or break off and there are, of course, no threads for the gases to work through.

The gases are mixed at the entrance to the discharge passage of the tip. There is no premature mixing or mixing in other than the predetermined quantities. Whenever a new tip is put in place, the mixture is automatically proportioned to the size of the tip. The Airco engineers have discovered a new method of torch operation and gas mixing which eliminates backfire or flashback in this apparatus. The mixture produced in the Airco torch approaches close to the theoretical proportion of one part of oxygen to one part of acetylene, affecting the maximum possible economy in gas consumption.

It is interesting to note at this point that the new torch has received the full approval of the Underwriters' Laboratories.

The conical projection of the head co-operates with the conical recess of the tip in a metal to metal seat. The tip held securely in place by a tip nut. This practice does away with threads on the tip as well as eliminating outside threading on the head. The tip is made of a special alloy selected after an extensive series of heat and endurance tests. The acetylene grooves are accessible and but a few seconds are required to remove carbon

Detached



Attached

Guaranteed Satisfaction or Money Refunded.

ATTENTION!

USERS OF

Prest-O-Lite Welding Torches

Convert your welding torch into cutting torch with one of the

A. & B. Cutting Attachments

Easy to Attach—No Flashback

Price $25.00 F. O. B. Indianapolis.

We carry a complete stock of welding supplies.

Genuine Tobine Bronze, High Silicon Cast Iron, Swedox Welding Wire, Special Steel Rods for all purposes.

A. & B. Fluxes for all metals—Hose, Goggles, Asbestos Gloves, Carbon Blocks and Carbon Paste.

Highest Grade Materials—Convenient Sizes.

Complete Welding and Cutting Outfits. Gas, Gas-Electric and Oil Preheaters. Prices quoted on application.

"We ship the same day."

WELDERS SUPPLY SHOP :: 223 Indiana Avenue Indianapolis, Indiana

"EVERYTHING FOR THE WELDER"

if cleaning becomes necessary. The torch head is drop forged of the same material as the tip, so that both these parts are subject to the same coefficienty of expansion and contraction.

The manufacturers have adapted the apparatus to a wide range of work by making it in four different sizes which are adaptable for all classes of welding from sheet metal to heavy castings. Different heads are also provided for special requirements. A range of tips is available providing flames from the smallest to the largest required in general practice.

THE I. C. S. WELDING COURSE.

On page 24 of *The Welding Engineer* for April we published an item entitled "Mail Order Welding Course." The article was worded in such a way as to give the impression that an instruction paper on welding sent out by the International Correspondence Schools was intended as a course in welding.

The booklet to which the article referred is as a matter of fact a very small part of courses which are intended to teach much more than welding operations. To illustrate, this booklet or instruction paper is included in the Boilermaker's course and on request is sent for reference purposes.

REPAIRS TO CAST IRON WHEELS.

Question.—In repairing flywheels and pulleys we frequently have failures which are probably due to wrong methods of dealing with the fractures. Can you give us some general principles to work on? M. W. & Co.

Answer.—Repairs to flywheels and pulleys are good examples of complex cases of expansion and contraction. They are practically all cases of restrained welds. A typical example of a restrained weld is a crack in the centre of a flat plate. If the crack is welded without preheating, the expansion of the metal from the heat of the blowpipe first closes the crack, as the colder outside part of the plate restrains it from going any other way. When the metal begins to cool there is a contraction of the hot metal which tends to produce the crack in the same place as before. This strain shows up in one of two ways. If the plate is of cast iron it will crack. If of steel it will warp. Preheating will not entirely remove the strain, as the melted metal contracts more than the preheated metal does. So that while the weld will stand, the plate will be under strain and may be slightly warped.

In the case of flywheels and pulleys with say, a broken arm, if this were welded without considering and allowing for expansion and contraction, the shrinkage stsrain would be so great that failure would occur. The method of work depends upon the size of the rim.

A heavy rim flywheel should be preheated red hot all over, or at least half the circumference of the rim should be preheated. This will cause the rim to expand outwardly, separating the edges of the broken arm. While in this state the weld should be made rapidly, and then the entire wheel allowed to cool slowly. If it were a pulley with a thin rim, the rim might be sprung out to get the necessary space between the broken ends of the spoke, but it is preferable to preheat the rim as previousy described. In thin rimmed wheels this repair can be converted into the case of an unrestrained weld by cutting the rim near the broken arm. Preheating is then not necessary.

If it is a case of a broken rim, a flywheel should be preheated all over, and a pulley may be sprung so as to separate the edges, but preheating the arms on either side of the break is best.

If the wheel is broken at the nave preheating is necessary because provision cannot be made for contraction.

If two arms are broken the same general procedure as given above can be followed.

If there is broken arm, rim and nave, any arm which will be strained by the cooling off of the nave should be cut. The nave should then be preheated and welded, then allowed to cool. The arms are next welded on the lines already indicated. The arms are next preheated to obtain the opening at the break in the rim; in the case of flywheels total preheating is only visable. After welding the rim cool off very slowly.—Ed. Acetylene and Welding Journal (London).

Vanadium and Filler Rods.

The June issue of Revue de la Soudure Autogene says:

An inquiry has recently been addressed to the Revue regarding the use of Vanadium as an addition to welding rods.

In 1914 the Union de la Soudure Autogene made an extended study on the influence of the vanadium additive to welding rods of iron, steel and cast iron. This study was more particularly for determining the value of vanadium as addition to the welding rod for welding soft steels, and at the beginning of the war commercial tests were about to be carried out. During the war some application was made by M. Marcel Pette who advises that the results are not as yet conclusive.

Certainly the use of vanadium in the laboratory has given excellent results; the weld is thoroughly deoxidized, the grain of the metal is fine and the elongation is greatly increased attaining in cases 20 to 25% without hammering or reannealing.

In practice though some defects have been apparent. It is essential that the percentage of vanadium should be not more than one ten thousandths, for in larger quantities it gives the weld the characteristics of a burned metal. If the torch employed is too large, the welder too rapid or too slow, the vanadium is burned or remains in the weld in too high a percentage and in either case the results are not good.

We believe that it is advantageous to employ vanadium in welding rods but in very small quantities to serve as an oxidizing element, but it will be claimed that there are other deoxidizers that can be employed that leave no ill effects on the welds. Silicon of course is widely used but it has the disadvantage of forming large grained welds. Manganese, aluminum and other oxidizing metals are used and diminish but little the strength of welds. Nickel, often proposed as a deoxidizing metal, has the advantage of slightly increasing the ductility of a weld. Tests on vanadium are still to be carried on and as stated before no conclusive results have as yet been obtained that would warrant its acceptance as the best oxidizing metal for welding.

The National Electro Products Co., of which Mr. W. E. Uren is general manager, will build five electrolytic plants in Canada. It is understood headquarters of the company will be at Toronto.

Mr. John A. Dittmer, president of the Southern Welding & Machine Co., San Antonio, Texas, recently completed a trip through the East and Middle West visiting the welding trade.

What substance can be spread on joints that are to be brazed so the brazing metal will not run over a certain line, i. e., a joint to be set into a hollow tube and brazed therein?

It is not advisable to attempt to weld a seam in a galvanized hot water tank, or a part of a seam. An attempt to weld usually loosens up rivets, and this also happens when trying to braze. It is best to solder these seams, and if this can't be done it will usually be found that the tank is not worth the labor of welding all of the seams. Cracks outside the seams may be welded or brazed.

IMPERIAL
WELDING CUTTING EQUIPMENT

You can't afford to use less than the best facilities in your repair work. Imperial Welding and Cutting Equipment is first in Safety, Speed, Economy and Efficiency. Its maintenance cost is low because of the small gas consumption, and a single operation often pays for its cost.

We are headquarters for Welding, Cutting, Carbon Burning and Lead Burning Equipment and Supplies of all kinds and ship on short notice. Write for the Imperial Catalog and full, detailed information regarding methods of operation, economies effected, etc.

IMPERIAL BRASS MFG. CO.

522 S. Racine Avenue CHICAGO, ILL.

Large rope drive pulley broken in seven pieces. Welded with Imperial Equipment.

Our Fluxes take the Guess Work out of Welding

We Manufacture a
COMPLETE LINE OF FLUXES on a SCIENTIFIC AND PRACTICAL BASIS
For Welding and Brazing

CAST IRON
ALUMINUM
COPPER
BRASS
AND OTHER METALS

If you will give our fluxes a trial you will be convinced of their superiority.

AMERICAN FLUX COMPANY

Sales Agency
P. O. Box 153, Mad. Sq. Station
New York City

Factory
East Acton
Mass.

WELDING PINCER
MODEL 3
Price, $1.00—3 for $2.50

Length, 16 inches. Weight, ½ pound. Holds the welding rod rigid at angle shown.

U. S. A. Patent No. 1301185, April 22nd, 1919. Foreign Patents Pending.

A slight pressure on small lever opens jaws.

SENT TO ANY WELDING SHOP FOR A 30 DAYS' TRIAL ON RECEIPT OF PRICE.
If not needed after that, return pincers and money will be refunded promptly.

Jobbers and Agents, write **C. SORENSEN, 18 E. 16th St., CHICAGO**

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

CONTENTS

Introduction.
I. Apparatus.
II. Operation.
III. Shop Equipment.
IV. Apparatus repairs.
V. Preheating Agencies.
VI. Part One—Welding of Cast Iron.
Part Two—Welding of Cast Iron.
Part Three—Welding of Cast Iron.
Part Four—Welding of Cast Iron.
VII. Part One — Steel Welding.
Part Two — Steel Welding.
Part Three — Steel Welding.
Part Four — Steel Welding.
VIII. Brass Welding.
IX. Part One — Aluminum Welding.
Part Two — Aluminum Welding.
Part Three—Aluminum Welding.
X. Welding of Malleable Iron.
XI. Oxy-Acetylene Cutting.
XII. Carbon Burning.
Glossary.
Index.

WELDING CONSTRUCTION *and* MINING EQUIPMENT

By Ben K. Smith*

During the past year the welding trade has been favored with a great many new developments, improvements and extensions which have multiplied the operations, and have invaded and conquered new fields with the aid of the oxy-acteylene welding and cutting torch.

One of the newly developed fields is the reclaiming of railroad construction and mining equipment. The principal equipment of railroad construction or mining operators is the well known steam shovel with its buckets. These buckets which are digging into dirt, rocks and iron ore, are constructed of hard steels and manganese steel. From the hard and constant usage, the walls, especially the front corners, were getting worn, bent, cracked and broken. In the past it was the custom to scrap whole or parts of these buckets and the expense of new buckets, parts or lips, were enormous. It was the author's pleasure to solicit and contract with one of the foremost mining and railway contractors of the Northwest, to weld six 4½ yard buckets with the usual guarantee of good workmanship or no charge.

From the appearance of these buckets before repairs were made, it looked like an impossible operation. However, with the aid of the welding and cutting torch, these buckets were straightened and welded and when completed, they not only appeared like new but have been giving good and satisfactory service, and incidently the owners saved about $1500.00 plus a great deal of time in waiting to secure new buckets or parts.

Figure 1 shows a square portion that was cut out with the cutting torch. The upper wall that consisted of four half inch plates riveted together, being bent, was straightened by applying two welding torches with No. 16 tips. These walls consisted of four hard steel plates half inch thick and riveted together. As a reinforcement, they had, about every two or three inches, heavy three inch angle irons, which were also bent. In order to strighten these angle irons and plates, it was necessary to cut the rivets through with the cutting torch, heat and bend up the angle irons about eight inches; then straighten all four plates with the aid of two torches, two jacks and a couple of heavy sledge hammers. After the plates were straightened, the angle irons were repaired and replaced and the corner portion which was worn was cut out in a rectangular form 26 in.x20 in., as per figure 1.

The next operation was to cut out with the cutting torch 16 new rectangular hard steel plates for each bucket, allowing a few extra inches of metal at the bottom where it was entirely worn out, and weld them at the corners and bottom of each bucket. In welding these plates, it was necessary to employ a special hard welding rod, so as to conform with the material of the bucket. As there were four thicknesses of plates, it was necessary to weld the two inside plates first, at the corners and bottom, as per figure 2. In order to weld and keep the plates straight, it was necessary to employ heavy C clamps and keep in absolute level line with the walls of the bucket. Figue 2 shows two such plates welded at the corners and bottom.

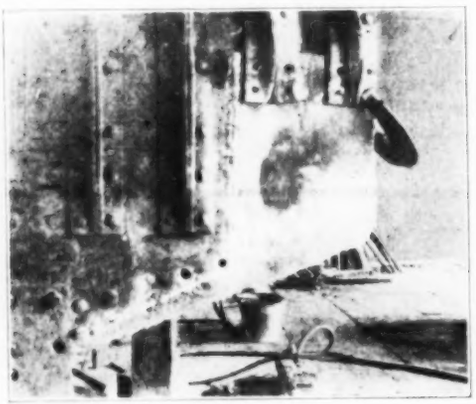


Fig. 2.

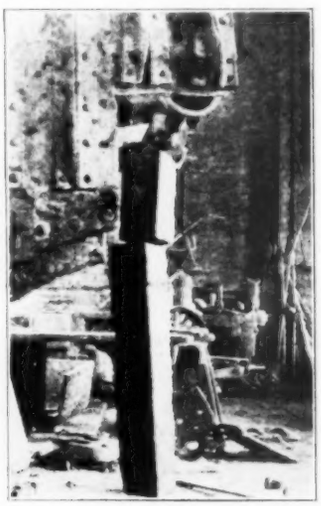


Fig. 1.

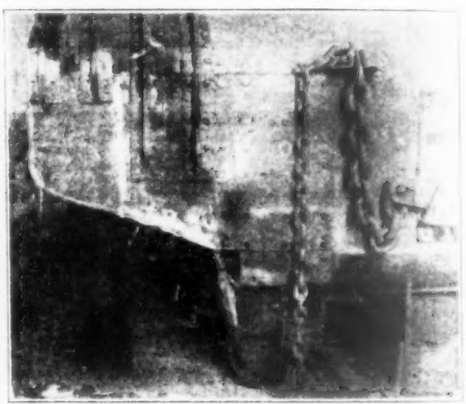


Fig. 3.

The next operation was to weld the two outside plates at the corners and bottom, using the same clamps, so as to keep the outside plates tight and in line with the inside welded plates. After all plates were welded we marked the bottom as per blue-print, with center punch marks and cut out with the cutting torch the extra metal through all four plates to its proper radius, as per figure 3.

One of the best advantages in welding these plates at the edges in front of the bucket was that no dirt or iron ore got in between plates during the digging, as would happen with a new bucket where the edges are not welded. When dirt gets in between plates, it will act like sharp wedges every time the bucket is lowered for digging purpose. The consequences are that the rivets are loosened

*U. S. Welding Co.

d the plates are bent or cracked until the bucket is put
t of service.

The last operation was to weld two or three cracks in
ch manganese lip as per figure 4. These lips are 1¼ inches
ick, sharp at one edge, square on the other, and the ends

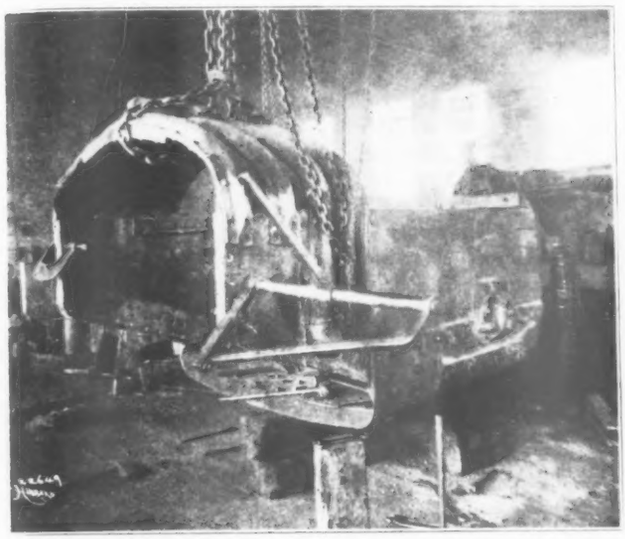


Fig. 4.

ent up the same radius as the bucket. The cracks were
bevelled with the cutting torch, and for the welding we used
ur special ¼-inch manganese welding rod.

Fig. 5.

Figure 5 shows one of the welded buckets in actual dig-
ging operation, and one can realize the enormous strain to
which the welded joints are exposed. Yet some of our
skeptical friends and inspectors do not also realize that a
properly performed steel weld will do just as good as a
new plate and 40 per cent better than a riveted joint. How-
ever, if some of our railroad and commercial welders who
insist that steel is the easiest metal to weld, will stop and
practice steel welding more seriously, it is the writer's con-
viction that our skeptical friends, or any other critics, will
diminish from our horizon.

Recently the author had the misfortune to witness a failure of a steel weld made by one of our foremost welders of the Northwest. The misfortune is not so much in the actual failure as it is the ignorance of the cause of failure. There is one great deception in steel welding and that is: "The fusing of the scale or oxide of iron before the steel proper is fused." A welder must know the difference between melted oxide of iron and that of steel, because the oxide of iron melts to about 300 degrees less than the steel itself, and as the former resembles the molten steel, some welders are fusing the welding rod into the scale or oxide of iron instead of to the steel. The consequences are that the welds will open up again or will crack at the least little strain. In opposition to this defective method of welding steel, others will exaggerate the fusing of the metal and will have hot steel running on cold spots with the result of cracks, blow holes and a decrease in the strength of the weld. The one who is joining the welding rod with the scale, has not sufficient heat at the end of his tip; the other who has particles of molten steel running in all parts, has too much heat or a rigid flame at the end of his tip. The proper way is to adjust the flame and keep it adjusted during the welding operation and thus reach the happy medium whereby one can make a steel to steel weld and also control the molten metal and cause it to lay where it was intended by the operator.

If some of our Northwest welders desire to see some of the welded buckets, it would be the pleasure of the author to show them to anyone interested in this class of work, providing appointment is made with him a few days before at the United States Welding Company's office.

AMERICAN BUREAU OF SHIPPING APPROVES THERMITE WELDING FOR MARINE REPAIRS.

An important development of Thermit welding in American shipyards is anticipated by the recent approval by the American Bureau of Shipping of the Thermit process for welding stern frames, rudder frames, and other heavy sections on ships registered under their classification. The only qualification is that this Bureau be notified sufficiently in advance to have a surveyor in attendance during the welding operation as well as to inspect and test the weld when completed.

While the Thermit process has been used since 1903 for making marine repairs and has a great many successful welds of this nature to its credit the process was never officially approved by the American Bureau of Shipping and most of the repairs were made on vessels not classed by them. It is due entirely to the unbroken record of successful marine welds that the Bureau now accords its official sanction to the process. According to a statement by the Metal & Thermit Corporation there has never been a single failure of a Thermit marine weld so far as it has been able to ascertain in all the years that the process has been used under this company's jurisdiction.

Now that the United States promises to have one of the largest mercantile marines in the world, and as practically all of the ships which have recently been constructed, and which will be constructed in the future, will be registered with the American Bureau of Shipping, the recognition of the Thermit process by that Bureau bids fair to result in many important Thermit marine welds from now on.

Calcium carbide quickly absorbs moisture from the atmosphere if left exposed to the air. The cans containing carbide are provided with a cover that can be replaced tightly, and there is no excuse for leaving a partly filled can uncovered. The practice is dangerous and wasteful.

CURFEW SHALL NOT RING TONIGHT

LOOKING backward over the years since I started in to learn something about welding, I am amazed to find how much we know in comparison with what we did know but a few years ago. Of course, we have really just begun even now to learn and the future will show uses of welding not thought of at this time; in other words, we have simply scratched the surface of possibilities of this wonderful process. Education of the operator goes hand in hand with new developments. But if we are just starting to learn now, I wonder just what our education consisted of in the earlier days!

Of course, our mistakes sound foolish to be well-trained man of today, but they were not foolish to us then. We had no text books, no trade papers, no way whatsoever of getting information except through our mistakes. They say that only fools learn by experience, but it was necessary evidently that we simply had to be fools, for there was no opportunity to learn by the other fellow's mistakes. Times have changed and today the reader of the trade paper may avoid these mistakes by reading about them instead of undergoing them—and this method I can assure you is much the cheaper.

Yet I would not have had it otherwise. I am so constituted that I have to be shown and those costly errors of earlier days of welding drove home to me basic facts which never will be forgotten. If I could only have learned them without having paid so much, the experience perhaps would taste a little sweeter, but having paid, I'm glad. You who read *The Welding Engineer* now buys for a couple of dollars in the way of a year's subscription that which formerly cost a couple of thousand and perhaps more.

And now for the plot. Unlike the two preceding reminiscences, I was not mixed up in this error of judgment, the sole reason being my absence from the city and not because of any superior knowledge. In a village about 25 miles out, the town bell had become cracked. It wasn't a very big crack—perhaps five or six inches or so—but it precluded the ringing of the bell so the local fire department was up in the air, the school kiddies didn't know whether they should attend sessions or not on a stormy day and the nine o'clock Curfew law was for the time being a dead letter.

The selectmen of the town decided upon a new bell, but the local garage man, having been one of those rare birds, a successful patron of our shop, put us in touch with the town fathers and our foreman went out for the usual price dicker. (Be it explained that in those days, we invariably made quotations to avoid the embarrassment of charging a man around $25 an hour on an itemized bill. If he was satisfied with the price quoted before his work was done, it didn't give him much of an opportunity to yell if he happened to know how long it took. Of course, he couldn't understand that he must pay for failures of other work and we could hardly explain these things to him; hence the rule for quotations.)

Now that particular belfrey housing that particular cracked bell was so constructed that taking the bell down would have been a terrific job and a costly one, so after casually looking the bell over, the foreman decided that it could be welded "in situ" as we were fond of saying, meaning that it could be welded in place without dismantling. A price of $150 was agreed upon, we to guarantee the bell would ring, but being careful not to guarantee the original tone and, of course, the selectmen were to hold us harmless if we did not succeed, but they in this case were to pay us nothing.

A couple of mornings later the auto trucks started on its 25-mile jaunt, carrying two equipments, four men, *steel welding rods*, and, of course, all the essentials to prepare, weld and finish; that is, the crew thought they had the essentials. The first surprise came when the break refused to respond to the action of the cutting torch which was to be used for beveling or grooving out the metal. Up to this time, no one had taken the trouble to find out what metal was used in bell construction and it had been taken for granted that it was wrough iron or mild steel. But when the break was chiseled into it was found that it was not iron, but a metal quite brittle, since it broke out in chunks rather than in chips and the color was grey or perhaps rather "whitish." It certainly was not brass and it didn't look like any composition bronze which had ever been welded in the shop. That day was spent by the four men in beveling the break and studying just how the weld should be made.

The next day only three men went out, this time carrying Tobin bronze welding rods and after getting the gas tanks up, little time was lost in getting started. The break ran to the edge and on the apparently valuable suggestion of one welder, the bell was tipped so that the crack would be on an angle considerably nearer horizontal than it was when in its natural position. As the bell was tipped, however, it became necessary for the welder to take a position rather precarious, half in and half out of the belfrey so when all was ready, the two other men hung on to the third in order to keep him from falling.

I wonder if the welder, as he lighted his torch, thought of the school-boy poem:

"Out, far out, she (or he) swung
Till the city seemed a tiny speck below."

Whether he did or didn't, his mind was somewhere else than on his job for he began the weld on the edge and started to work toward the top of the bell. He had progressed about an inch when the crack lengthened a couple and as well, the weld he had just made opened up. This made it necessary to again chisel out the metal which had been added and again the weld was started as before and with about the same results; but this time smaller cracks appeared, running into the break at various angles.

That day was done, so back to the shop came the men, tired and discouraged and each one cussing that peculiar metal. The foreman decided upon an analysis of one of the chunks which had been chiseled out and at a cost of $25 learned that it was bell-metal and that this particular sample was about three parts copper and one part tin. A local foundryman cast the same metal in the form of welding rods at a stiff price and with courage born by the removal of uncertainty as to what the metal was, the crew went back to the job. Another day's work with the new welding rod didn't improve the bell any and that day ended with the crack ten or twelve inches long and quite a large number of little tributaries running into it.

By this time it had dawned upon the welders that the extension of the old crack and the addition of many new ones was caused by contraction so an oil orch and considerable asbestos was added to the equipment and preparations made to preheat. Can you picture that crew in a wooden belfrey, the wind howling through it, trying to preheat a bell with a powerful oil torch hot enough to prevent contraction cracks, but with no fire bricks and no way of using them if they had them? Can you realize the difficulties of keeping "the old tower" from burning up and the burns all of them received when tipping the bell?

Of course they didn't succeed. New cracks appeared under the heat of the oil torch, but that crew didn't give up for a couple of days and when they did, the bell was hopeless, but they had learned something—they knew what bell metal was and they had had a lesson in expansion and contraction which stuck. Incidentally, the lesson "stuck" me their wages, a goodly number cubic feet of gas, I don't know how many pounds of welding rods and the wear and tear and gasoline for the auto truck used in the voyage of discovery. But we all learned the

Moral: An Ounce of Consideration is Worth a Pound of Second Guesses.

GENERAL WELDING & EQUIPMENT CO.

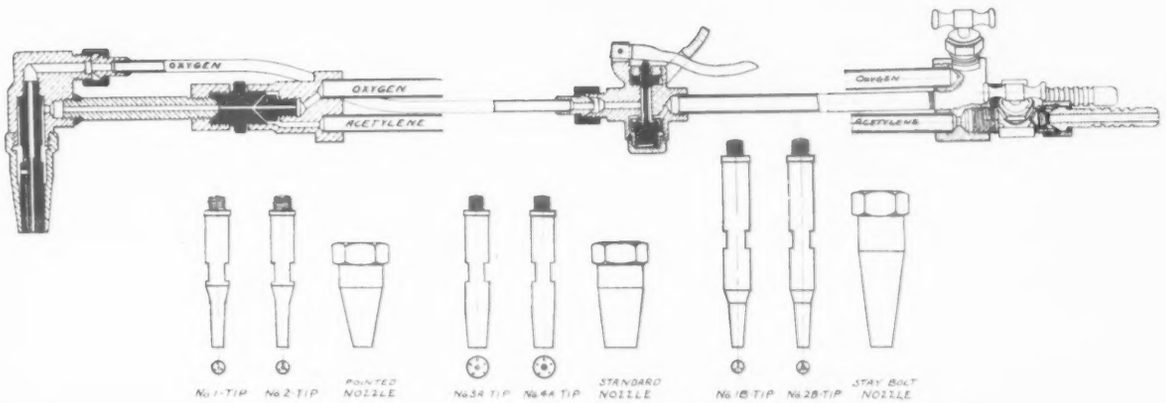
G.W.&E.CO.

107 MASS. AVE. BOSTON, MASS.

THE FAMOUS "K" CUTTING TORCH

Many thousands of these remarkable cutting torches are in continuous use all over the States and Canada.

We make immediate shipments of torches, tips, nozzles and other spare parts.



One of the Best and Most Economical Generators Manufactured

Manufacturers of
Welding and cutting apparatus
Lead burning outfits
De-carbonizing outfits
Welding torches
Cutting torches
Sheet metal torches
Battery torches
Acetylene torches
Regulators
Safety lighters
Carbon rods
Carbon paste
Gauges
Hose
Goggles

Electric and Oil Preheaters
Cast iron rods 24 in. long
Tobin bronze rods
Manganese bronze rods
Aluminum rods
Aluminum solder
Brazing wire
Brass spelter
Wire { Norway, Sweden, Superior, Vanadium, Nickel }
Asbestos paper
Asbestos gloves
Welding plates
"V" Blocks

Superior Oxy - Acetylene Machine Co.

Our New England States Representative,
R. I. WELDING CO., Providence, R. I.

Hamilton, Ohio

Fyber-Weld GOGGLES for Welders

Fitted with "Essentialite" Lenses

Frame is made entirely of vulcanized fibre, and in addition to being light in weight is a non-conductor of heat and electricity, is non-inflammable and infusible, is not affected by moisture or perspiration and is easily sterilized and kept sanitary. Has flexible leather center, ventilated side pieces and adjustable elastic headband.

Prices as follows:

No. 510, fitted Essentialite lenses, No. 4 shade, for cutting and cover glasses ..... $3.00 pair
No. 510, fitted Essentialite lenses, No. 6 shade, for welding and cover glasses ..... $3.00 pair
No. 510, fitted with amber, smoked green or deep blue, cesco blue and cover glasses $2.50 pair
Extra cover glasses in clear or amber tint ..... .20 pair

"ESSENTIALITE" LENSES

To those of our patrons who are not thoroughly conversant with the real qualities and benefits of "Essentialite" lenses, we take pleasure in furnishing the following information. In placing the "Essentialite" before the trade, we have, after years of experimenting and research, succeeded in discovering the means of protecting the delicate organism of sight against the destructive Ultra Violet rays. We have demonstrated conclusively that with these lenses we vanquish the so-called "fatigue-weariness" and headaches caused by Ultra Violet and Infra Red rays.

Manufactured By **CHICAGO EYE-SHIELD CO., 2300 Warren Ave., Chicago, Ill.**

CHINA ENGLAND MEXICO

order

"U. S." WELDERS MOULDING COMPOUND

One mail recently brought orders from:—
Alfred Hauert, Shanghai, China.
John U. Lee & Co., Hull, England.
Anglo-Mexican Petroleum Co., Puerto, Mexico.

Practically every country in the world is now using this wonderful fire resisting compound. It does not blister, or work into the weld; takes the place of carbon blocks and rods; saves holes and machined surfaces; makes casting of missing lugs and other parts very simple; and as a cushion for pre-heating work and in aligning work, shims are forgotten and 50 per cent of the welder's time is saved by using this compound.

HAS 1000 DIFFERENTUSES

5 lb. "U. S." Welders' Moulding Compound, with directions $2.50
(100 lb. and over—40c per lb.)

Manufactured Exclusively by

UNITED STATES WELDING COMPANY, INC. MINNEAPOLIS, MINNESOTA, U. S. A.

Classified Ads

Help Wanted—25c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—50c per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

Wanted—Salesman to solicit subscriptions to *The Welding Engineer*, or furnish names of possible readers. Compensation good. Correspondence confidential. Write Mackenzie.

FOR SALE: 200-lb. Low Pressure Oxweld Generator, with tank. In use only two months. As good as new. Best offer will be accepted. B. H. Voss, 74 East Fort St., Detroit, Mich. 1t-sep.

Wanted—Agencies for the sale in Italy of sheet metals, either mechanically made or by electricity, including tools or machine tools. First-class technical references and financial guarantees. Address Vittorio, 527 Hamilton Avenue, St. Louis, Mo. 1t-Sept.

Position Wanted—Mechanical Engineer. Cornell graduate. Several years' experience in shops of leading locomotive manufacturers. At present manager of highly successful job welding shop. Seeks connection with large manufacturer or welding equipment firm in an engineering or executive capacity. Address Cornell, care The Welding Engineer. 1t-Sept.

Wanted—To purchase WC and WK Prest-o-Lite CyEnders. State price. Memphis Welding Co., Memphis, Tenn.

Wanted:

By large manufacturer of equipment, a high grade man as special sales representative. Must have experience in electrolytic oxygen also welding and cutting apparatus. Splendid opportunity to advance rapidly to position of Sales Manager. Do not reply unless you have had wide experience in doing business with big men. Address B222, care The Welding Engineer. 1t—Sep

Foreman Wanted—First-class job welding foreman. Must know heavy work in both cast iron and steel; $200 per month to right man. Address Mackenzie, care The Welding Engineer. 1t-Sept

Wanted.—By an experienced oxy-acetylene welder, a demonstrating or steady welding job. V. C. Rilling, 311 Bush Street, Toledo, Ohio.

Wanted—Experienced acetylene and arc welder wishes responsible position. Capable of installing electric welding plant. Prefer foremanship. Address R. C. DeClements, 5622 Alki Ave., Seattle, Wash.

Wanted—Good, all-around job shop welder. Wages thirty dollars per week. Steady position. Address, John A. McDonald, Zenith Welding Co., Duluth, Minn.

POSITIONS VACANT

The Alexander Milburn Company of Baltimore, have several openings for Executives, District Sales Managers and Assistant Salesmen.

Exclusive territory to District Managers, with liberal salary and commission. Good opportunities for advancement to executive positions are open to capable men.

Applicants are requested to give the fullest details as to age, experience, etc. Same will be held in strictest confidence.

Address: Mr. J., 1416-28 W. Baltimore St., Baltimore, Md.

Superior Brazing Compound

Send for Free Sample

A product of years of time and study. Over 98 per cent pure boron and is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

Standard Mfg. Co.
318 S. Canal St., Chicago

THE KING FACE MASK

The greatest innovation in the matter of eye protection for welding and cutting operations is a new model face mask just placed on the market by the Julius King Optical Co., 10 Maiden

Lane, New York, N. Y. It was found that welders in the Navy Yards complained against goggles being heavy, too hot, and offering no protection from splashes of metal lodging between the eyes above the nose. The new mask is supported by a band

over the head, so the weight is not apparent and is as comfortable to wear as a cap. The mask itself is made of fiber and as a consequence will stand almost any amount of abuse and last indefinitely. It may be turned back over the head when not in use. There is a free circulation of air between the front and the face, not only keeping the operator cool, but preventing the tendency of the lenses to fog. Special lenses may be fitted and replacements made in little time and without the use of special tools.

COMPRESSED GAS MANUFACTURERS' ASSOCIATION.

A circular has recently been issued by the Compressed Gas Manufacturers' Association, 23 East 26th St., New York, urging all reputable manufacturers of compressed gas equipment and machinery to join the association. Dues are $10 per year.

ADVERTISING THE WELDING SHOP.

By L. B. Mackenzie.

Probably there is no single branch of mechanics about which the general public understands so little as the art of autogenous welding. Beyond having a vague idea that his automobile cylinders or crank case can be repaired by means of welding the average citizen knows very little about welding. So it often happens that when the citizen is confronted with the necessity of seeking the services of a skillful welder he usually depends upon the advice of some garage employe, with the result that a comparatively easy job of welding turns out unsatisfactory, much to the disgust of the owner of the part which is being "miswelded," and very much to the discredit of the welder and welding in general.

What the welding trade needs most of all is more and better advertising-publicity of such a character as to uplift and advance the whole trade. Now by "welding trade" I mean the men on the firing line, the men who are operating the repair and job welding shops of the United States. The manufacturers of welding equipment are rapidly educating the big users of equipment and the potential users of equipment as to the utility and economy of welding processes, and the war pushed them along several years, but the class we might term the retailers of the business, the job welding shops, have not kept pace with this progress. These shops need more and better advertising.

In the past few years hundreds of successful job welding shops have been established in cities and towns and villages all over the United States. Today it would be hard indeed to find a locality which could not boast of at least one welding shop which did not lay claim to being able to weld "everything but a broken heart." Many of these shops have succeeded in spite of themselves, and not because of any concentrated and intelligent effort to advertise their ability to their prospective customers. Very rarely indeed will you find the man who is handy with the welding torch to be very skillful in his publicity campaigns. Doctor Welder will never create any very decided sensation in the ranks of the skilled advertising directors.

The art of advertising, like the art of autogenous welding, is an exact science. There is no hit or miss about it. Consideration of the growth and prosperity of thousands of our national advertisers proves this point. Money judiciously spent in advertising is just as safe as though it was in the bank. Like a good insurance policy—it is accumulative. The returns grow as time passes. I do not lay claim to being an *expert* in the art of advertising, but I do claim to have had more experience and training in the advertising field than most welders, and because of this and because of the fact that I am also acquainted with the trials and tribulations of the welder I have undertaken to express my views on the subject of educating the general public as to what the welder can do for him.

The man who would be successful and make his advertising campaign pay, no matter how small or how large his campaign may be, must first of all consider one point. Have you anything to advertise? If you can't answer this question to your own satisfaction then your money would be safer in Russia than it would be invested in advertising of any sort. If a job of welding is brought into your shop can you deliver the goods—can you do the sort of work you propose to advertise you can do? If you are a good workman, or if you employ good workmen and you have the tools and the equipment to turn out first class work, then indeed you have a right to rise up and dare the people to bring their welding troubles into your place of business.

People do not, as a rule, search for advertisements—the advertisement must search for the people. This is not so true of trade magazines, such as *The Welding Engineer*, because in pub-

lications of this class the advertising sections are usually just as informative and contain just as much news as the reading section. It is true, however, of most newspapers and magazines. They are bought for their news and stories, and the successful advertisement must, so to speak, hop right out of the page and challenge the attention of the reader.

Oddly, the farmer is usually a good advertiser. He knows nothing about hackneyed catch phrases. When he has a mule to sell he puts down some such headline as "Good Mule For Sale," and then he tells all about the mule. That's good advertising because it's brim full of information and its directly to the point. A good advertisement should contain a lot of information—that's the purpose of the advertisement.

The standing card in the local newspaper is something like a standing army. It's well trained to stay where put and good as far as it goes, but for real effectiveness it's got to be reinforced. Both England and the United States recently had an ample proof of the truth of this statement.

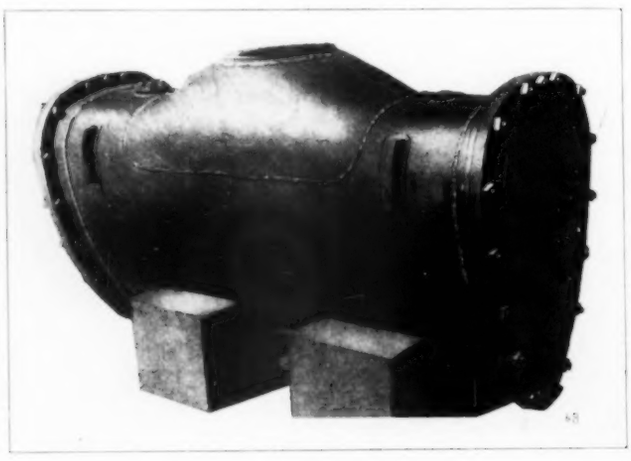
Note—This is the first of a series of articles on this subject. Job Shops are invited to send us their advertising literature and The Welding Engineer would also be pleased to receive communications from the whole trade on the subject.—Editor.

PLASTIC-ARC WELDING.

Its Past and Future in Ship Repair and Construction.

By J. O. Smith.*

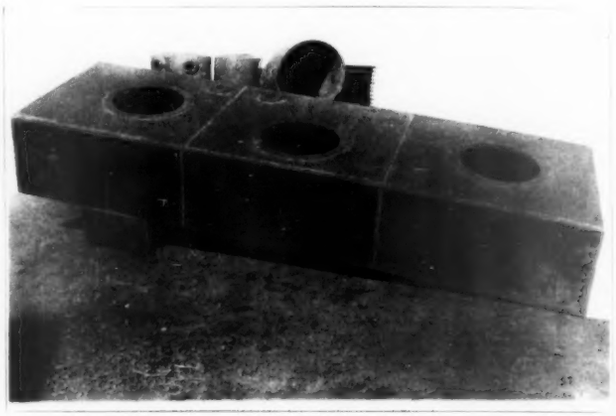
The Wilson Plastic-Arc Welder, which was used in repairing some of the German Ships, had been in use under development on a large eastern-railroad for a long time previous to the outbreak of war in 1917, and it was the results achieved by it in welding heavy cast-iron locomotive and other parts that cause



the Navy Department engineers to turn to it as a means of repair in the case of the damaged German Ships.

The repairing of these ships by arc-welding marked an epoch in the affairs of men, in that it brought into practical use a branch of the electrical industry that had, up to that time, never been employed on so extensive a scale or with the same incentive. The successful repair of the large cast-iron cylinders and other parts of the German Ships had led naturally to consideration of arc welding in the manufacture and repair of metal products and parts of all kinds. The attention of engineers generally has been attracted by its possibilities, and the great achievement of successfully repairing the damaged ships has naturally given the subject great prestige among shipping and shipbuilding interests.

When the matter of welding in connection with ship construction is considered, immense possibilities immediately suggest themselves. It has been definitely determind by exhaustive technical study and experiment that welding can be satisfactorily employed in ship construction, that ship plates jointed by welding will be as strong, or stronger than the original metal, at the



welded joint, and that welding can be employed for ship construction work at a saving of 25 per cent in time and 10 per cent in material, as compared to riveting.

In actual figures, as determined by experiments of the Emergency Fleet Corporation's Electric Welding Committee it was determined that by welding in the case of a 9,500 ton ship, the saving in rivets and overlapped plates would amount in weight to 500 tons, making it possible for the ship to carry 500 tons more cargo on each trip than would be possible if the ship plates etc. had been riveted, instead of welded.

An investigation by the Electric Welding Committee of the

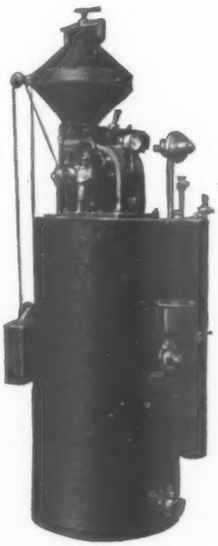
Fleet Corporation has definitely established the following points:

That electric welded ships can be built at least as strong as riveted ships.

That plans for ships designed to be riveted can easily be modified so as to adapt them for extensive electric welding and thus considerably save in costs and time for hull construction

*Wilson Welder & Metals Co.

Acetylene 1¼c per foot



If you generate it with a

MECO

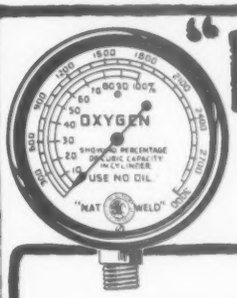
Type FG Portable Automatic Acetylene Generator

Made in 25-lb., 50-lb., and 100-lb. Capacity

Write for prices and literature

Modern Engineering Co.

23rd and Walnut Sts., ST. LOUIS, U. S. A.



"NATWELD" GAUGES

Independent Movement
Screwed on Rings
Non-ferrous Throughout

These features insure continued accuracy even during excessive vibration, temperature changes and rough handling. Send for sample set.

Look for the INDIAN HEAD *Trade Mark*

NATIONAL GAUGE & EQUIPMENT CO.
LACROSSE, WIS.

Kresge Bldg. DETROIT — 51 E. 42nd ST. NEW YORK — Railway Exchange Building CHICAGO

Genuine Swedish Charcoal Iron Bars

FEDERAL TOOL & ALLOY STEEL CORPORATION

Genuine Swedish Charcoal Iron Welding Wire

Best Swedish Brands
Immediate Shipments From American Stocks

There is no substitute for Genuine Swedish Charcoal Iron on the score of quality

Federal Tool & Alloy Steel Corporation

Thomas Towne, 1st Vice President and Gen. Mgr.

General Office: Woolworth Bldg., New York City

Branch Offices and Warehouses:
66 Rutledge St., Brooklyn
1280 Ontario St., Cleveland
654 W. Lake St., Chicago
319 Metropolitan Bank Bldg., New Orleans

That ships especially designed for electric welding can be built at a saving of 25 per cent over present methods and in less time.

An electrically welded ship is credited with many advantages over a riveted ship. In a 5,000-ton ship about 450,000 rivets are used. A 9,500 deadweight-ton ship requires 600,000 or 700,000 rivets. By the welding process the saving in labor on the minor parts of a ship is reckoned at from 60 to 70 per cent, on the hull plating and other vital parts, the saving in labor, cost and time of construction by welding is conservatively placed at 25 per cent.

That electric welding will some day largely replace riveting is also the judgment of the Electric Welding Committee, composed of 82 of the leading experts in both the electrical and metallurgical branches of the welding field.

Considerable investigation of the subject of welding instead of riveting has been made in England by Lloyd's Register of Shipping particularly with regard to formulating rules for application to the electrical welding of ships. As a result of the investigations and experiments made by the Society's technical staff, it was determined that the matter had assumed such importance as to warrant the formulation of provisional rules for electrically welded vessels, and these have been issued for the guidance of shipbuilders by Lloyd's Register.

The experiments conducted in England followed three well defined lines of investigation: Determination of ultimate strength of welded joints, together with their ductile properties; capability of welding joints to withstand alternating tensile and compressive stresses, such as are regularly experienced by ships, and microscopic and metallurgical analyses to determine if a sound fusion was effected between the original and added metal.

It was determined that the tensile strength of the welded joints was from 90 to 95 per cent of the original plates, as against a strength of from 65 to 70 per cent, in riveted joints, showing a margin of 25 per cent increased strength in favor of the welded joints.

The result of the tests of the elastic properties of welded joints determined that there was a slight difference in favor of the riveted joint, but the art of welding has made such great strides recently that it is now believed entirely possible to make a welded joint, in ship plates that will stand as great a number of reversals of stresses as a riveted joint.

Microscopic and metallurgical analyses has determined definitely that a good solid, mechanically sound weld was made between the original and the added metal, the two metals having been fused together so perfectly that no line of demarcation could be seen.

The rules so far promulgated by Lloyd's have been necessarily of a tentative nature and will no doubt be modified and enlarged from time to time in view of the experience that will be gained after a few welded ships have been in service for a time.

It does not require a great deal of imagination, however, to enable anyone to form the opinion that the shipbuilding industry is on the eve of great modifications in constructional lines, and the guidance given the shipbuilding industry by the tests and comparisons so far made will undoubtedly lead to important, radical departures and developments in the industry.

In addition to the increased cost of riveting as compared to welding, it is practically always true that there are a certain percentage of imperfectly fitted rivets, that have done nothing more than ad weight to the ship. The main purpose of a rivet, of course, is to bind two or more thicknesses of plate together, but if the rivet is bent, loses part of its head in the riveting process, or otherwise fails in its proper purpose, there is no method by which such faults can be corrected after the rivet cools. It must be removed entirely if the importance of the riveted part requires a perfect joint, and this is frequently a time-killing, expensive course to follow. When it is considered that a 5,500 ton ship requires approximately 450,000 rivets to bind the various parts and plates and also that a certain percentage of these rivets are not fulfilling the purpose for which they were put into the ship, it is quite evident that practically every ship is burdened with a good-sized load of dead, useless weight. Such defective rivets are in fact, more than a useless weight, in that they are a menace to the ship for while they have been built into the ship for a purpose, and are supposed to be fulfilling that purpose, there is no telling how much the ship has been weakened structurally by their failure.

There are many reasons for defective rivets, and one of the greatest of them is in accessibility, and consequent difficulty on the part of the riveter in putting the rivets properly in place. Another reason is that there is no certainty that rivets are at a proper, workable temperature, in consequence of which if they are too cold, the pneumatic hammer now generally used in riveting is unable to round off the end of the rivet properly so as to insure a proper binding together of the plates the rivet is supposed to hold.

In many cases, when such leaky rivets are discovered, the present-day method is to weld such defective spots, which immediately brings up the natural question as to why the plates should not be welded in the first place.

The ability of a welder, using a direct current, low voltage arc with automatically regulated current to make sound mechanical welds in cramped, confined spaces, on overhead or vertical walls, in fact, anywhere a man and a wire can go, naturally suggests that welding shipplates together should be the primary operation in shipbuilding, and from present indications and the trend of current event, it seems more than likely that this will be the outcome in the near future.

ELECTRIC WELDING

By ERIK OBERG

A Practical Book on This Important Subject and One That Embodies the Results Obtained and the Methods Used by the Most Prominent Concerns in the United States.

295 Pages, 6x9 Inches, 213 Illustrations

PRICE, $3.50

Electric welding has become so important an art in the mechanical industries that a comprehensive treatise on this subject covering both the resistance and the arc welding processes is needed in the trade. A special study of the subject has, therefore, been made by the authors of this work, who have been assisted in their work by the experts in resistance and arc welding of some of the most prominent concerns in the United States engaged in this line of work.

Consultations with the experts of these companies have made it possible to obtain thoroughly up-to-date information embodying the latest developments and discoveries in the art, and it is believed that, for this reason, the book will prove especially useful to those who are already employing electric welding equipment or who are contemplating its use, as well as to the students of the subject who desire to obtain authoritative information on the electric welding processes.

CONTENTS

Electric Welding Processes—Electric Resistance Butt-Welding Special Butt-Welding Machines and Processes—Electric Spot-Welding—Seam-Welding and Riveting—Percussion Welding—Electric Soldering—Principles of Electric Arc Welding—Applications of Electric Arc Welding—Welding Transformer Tanks by Electric Arc.

"Electric Welding" is splendidly bound in green cloth. It is fully illustrated with cuts and engravings and gives in its 295 pages exactly the data and information on electric welding that the man in the machine building plant requires.

THE WELDING ENGINEER 608 S. Dearborn St. CHICAGO

DUCTILITY IN METALLIC ARC WELDS

By J. Churchward.

This has been the subject of a number of papers, one of which I will endeavor to interpret as I understand it.

A certain well known metallurgist, a member of the Research Committee of the Bureau of Welding, has been kind enough to contribute a considerable amount of his time to this subject. As I understand his results, the lack of ductility in metallic arc welding is due to the ultra-microscopical films of iron oxide which surround the grains and thereby cause in every case an intergranular fracture and in no case, as he observes, a transcrystalline fracture. His view is held by the majority of engineers who have worked on this subject. Though he does not state this fact, I am of the impression that he has undertaken all his experiments with a welding electrode of comparatively low carbon and manganese; that is, under .20 carbon and .60 manganese. The tests in this article are with wire of approximately .35 carbon and 1 per cent manganese made by a special process which I am not at liberty to divulge, in comparison with a low carbon and low manganese electrode.

The question has often arisen as to the proper method of measuring the elongation of the welded specimen—should the elongation be measured across the weld or should it take in an inch or two inches of the parent metal? If the engineer wishes to measure the elongation of the test piece as a unit, not taking into consideration the fact that he is dealing with two materials, which while they may have the same chemical composition, are widely different in structure the proper method would be to take the elongation in either two or four inches using the weld as a center; if, however, the engineer wishes to know the physical characteristics of the material deposited in the weld, the proper method is to measure, the elongation in one inch across the welded material. This has been the case in the physical tests following:

Voltage	Amperage	Elastic Limit	Tensile Strength	Elongation	Brinell
35	125	38,450	66,750	18%	153
		42,800	62,650	21%	159
		42,200	66,300	21%	153
		43,150	68,600	21%	149
		44,800	65,600	20%	146
		46,160	64,800	20%	153
Average		42,925	65,780	20%	152
		36,750	62,600	18%	.....
		33,600	58,850	16%	.....
		38,050	60,050	22%	.....
		36,200	56,700	17%	.....
		42,500	62,100	22%	.....
Average		37,420	60,600	19%	.....
		43,450	63,600	24%	.....
		42,500	62,750	23%	.....
		45,500	62,600	24%	.....
		42,950	61,900	22%	.....
		39,400	60,950	22%	146
Average		42,750	62,360	23%	.....
		33,350	60,150	18%	160
		32,400	62,700	20%	150
		32,650	65,650	20%	150
		38,550	60,300	20%	158
		28,500	59,500	17%	159
		31,050	58,100	17%	144
Average		32,750	61,070	18.7%	150

The following tests are made with low carbon, low manganese wire to show the comparison:

Voltage	Tensile Strength	Elongation
35	52,800	6.25
	53,300	6.25
	53,800	6.25
	57,200	6.25
	57,800	9.38
	52,200	9.38
	56,800	7.80
	53,300	6.25
	55,600	9.38
	53,700	7.80
	55,100	9.38
Average	54,700	7.67
	58,600	10.90
	54,200	10.90
	54,600	10.90
	56,000	9.38
	57,500	9.38
	58,700	9.38
	57,300	9.38
	56,500	10.90
	57,000	9.38
Average	56,700	10.00
35	59,000	9.37
	56,900	6.25

Microscopical analyses of two pieces of metal—one which had an elongation of six per cent and one an elongation of twenty-three per cent show practically the same structure, the difference evidently being due to the absence of the ultra-microscopical film of iron oxide in the test piece with the twenty-three per cent elongation.

In conclusion, it would seem that ductility in electric welding is possible to a greater extent than in oxy-acetylene welding, although in the former case it is not so much a question of the ability of the operator as it is the use of the proper kind of material, and the proper heat used and maintained in depositing the metal.

In view of the physical tests which are included, it would not be too much to surmise that physical characteristics can be controlled to a certain extent by heat treatment. J. C.

WELDING SCHOOL AT RICHMOND

A Richmond, Va., newspaper states that a course in oxy-acetylene welding will be made a part of the vocational department of the public schools there. Mr. J. E. Histead, inventor of the

Histead's New Goggle. For Welders and for Auto Drivers.

goggles which bear his name, will be one of the instructors. His address is 103 N. Fourth Street, Richmond.

WELDING FIRE BELLS

Editor: In answer to yours of the 24th instant beg to advise you that at various times we have attempted to have our fire bells welded but without any degree of success. There is no place in Chicago that I can recommend to you where bells may be welded and the original tone preserved. We find it more profitable to renew the bell.

Thomas O'Connor,
Fire Marshal.

The National Oxygen Co., Chicago, are handling "Victor" welding and cutting apparatus in territory covered by their various offices.

D-B DECARBONIZING OUTFIT

Carbon deposits in the cylinders of motor cars and trucks cause knocking, thumping, overheating, backfiring, loss of power, excessive wear and waste of oil and gas. No more serious trouble from any cause is experienced by the average car driver than arises from carbon. Many an engine has been sent to the repair shop for overhauling when it needed only a thorough cleaning of the cylinders, pistons and valves to rid them of the carbon plague. A host of carbon compounds and carbon-removing devices have been offered to the public, but it is generally conceded that the only sure cure for the disease is mechanical removal with scrapers or burning out with oxygen. To remove carbon from an engine by scraping generally requires taking off the cylinder head or pulling the engine apart and lifting off the cylinder block in case it is of the closed end type. The labor of dismantling and assembling is much greater than the actual cleaning.

Burning out carbon with oxygen is a simple process that can mastered quickly by any garage mechanic. There is absolutely no danger of burning or warping engine cylinders, pistons or valves. The heat of the burning deposits is never sufficient to overheat the metal. Care should be taken to blow out all loose unconsumed debris, as these may contain road dust or grit that would cut and score the cylinders and rings if left in the cylinders.

Outfit Required for Carbon Burning.

The apparatus required for carbon burning is simple and inexpensive. It consists of the gas cylinder containing oxygen under pressure of 1,800 to 2,000 pounds per square inch, when received from the service station, a pressure regulator; hose and flexible metal nozzle or torch. The high pressure of the oxygen in the service cylinder cannot be used without the pressure reducer as the pressure required for carbon burning is from 5 to 15 pounds only.

The pressure regulator carries a gauge, showing the working pressure of the oxygen supplied to the hose. The pressure is controlled by the regulator screw. The hose nozzle, or torch, consists of a thin copper tube that can be inserted in the cylinder through the spark plug opening and bent so as to reach all parts of the interior. A handle and valve are provided for convenient manipulation of the nozzle and control of the gas flow.

How to Burn Out Carbon.

Place a hand fire extinguisher where it can be reached in case of need. Disconnect or shut off the gasoline feed and run the engine until the gas in the carburetor is exhausted. If the car is equipped with a vacuum feed apparatus, it is advisable to drain or remove it to prevent waste and danger of fire. Provide a piece of canvas or sheet of asbestos paper with openings in the middle to spread over the top of the engine and prevent flying sparks igniting the oil in the sod pan. Disconnect the spark wires, noting the order of connection, and remove the spark plugs, and bushings, if any. Set up the decarbonizing outfit, screw the pressure regulator to the cylinder valve, connect the hose, open the torch needle valve and then slowly open the cylinder valve as far far as it will go, turning the handle from right to left. Open the regulator slowly by turning the cross bar screw to the right until the pressure gauge indicates 15 pounds pressure. Close the needle valve in the torch. The decarbonizing outfit is now ready for use.

Crank the engine until the first piston in front stands at the top of the stroke with the valve closed. The position of the valves can be determined by looking at the tappets, or by feeling with a wire through the spark plug hole. Spread the canvas over the engine with the opening over the spark plug hole. Light a small wad of kerosene-saturated waste and drop into the cylinder, push the torch nozzle in after it and open the needle valve slowly. The carbon will immediately take fire and burn with popping noises and puffs of gas. If the deposits are heavy and oily, reduce the oxygen pressure and that will check the explosive action. Work the nozzle around so as to direct the stream of oxygen against all parts of the interior, including the valves. Carbon will not burn unless it is in an oxygen atmosphere. If the fire goes out before the job is finished, relight as before and continue burning until the cylinder and valves are thoroughly cleaned. Blow out all unconsumed loose deposits and squirt a few teaspoonfuls of kerosene into the cylinder.

Having finished with the first cylinder, crank the next piston to the high point with the valves closed and proceed as before, and so on until finished. The operator should work quickly in order to use as little oxygen as possible. When not actually burning carbon, the gas supply should be cut off with the nozzle valve, and not needlessly wasted. From three to five cubic feet of oxygen per cylinder are generally sufficient.

Even if the valves of a removable head engine have to be ground it is nevertheless, considered good practice to burn out the carbon before removing the head as it can be cleaned out as thoroughly and with as little labor as by scraping.

D-B Garage Outfit.

The decarbonizing outfit furnished by the Davis-Bournonville Co. consists of a special pressure regulator, 12 feet of Midget Ebony hose and torch with ball handle and needle valve. Oxygen cylinders are not furnished. These may be obtained from the regular gas service stations.

THE WELDER IN LOCOMOTIVE REPAIRS.

The importance of having competent welders, particularly in the repair of locomotive boilers, was again emphasized at the recent convention of the Master Boiler Makers' Association. The boiler being, so to speak, the heart of the locomotive, any laxity in its construction or inspection is usually followed by disastrous results. One vital feature of boiler making and repairing is the practice now becoming quite extensive, of welding patches to the sheets when repairing cracked or otherwise defective parts of the boiler. There is no other form of repair work that may be so easily slighted through incompetent or careless workmanship and still pass the required inspection, only to fail at some critical moment in the operation of the locomotive. Many excellent papers are published from time to time in the technical journals, devoted to railroad questions and it is the duty of the men who have taken up welding to keep themselves fully informed concerning the methods and progress of the art of welding. Both the electric and the acetylene gas welding apparatus have been developed to a point where they require only careful and intelligent operation to secure satisfactory results. Anyone taking up this line of work may be assured of every assistance from the manufacturers of the welding outfits, as well as from their shop foremen and should not fail to take adavntage of every channel of information available. The importance of careful welding in every repair made to a locomotive boiler cannot be too strongly impressed on those who are engaged in this work.—Railway Mechanical Engineer.

WASTE OF OXYGEN.

The waste of oxygen in cutting in some plants is appalling. We recently saw a Pyrograph in operation bevelling the flanges of a steel combustion chamber head, ¾ inch thick. The machine was doing wonderful work and at a rate that put all other means of trimming and bevelling far in the shade. But the oxygen consumption was at least three times the amount that it should have been, if any regard whatsoever was to be paid to the question of gas cost. While it is true that the cutting rate can be somewhat increased by excessive oxygen consumption in a torch, the gain is obtained at a cost all out of proportion to the work. It is better to make haste slowly with the cutting torch. If the volume of work is in excess of what one man can accomplish with his torch operating at fair efficiency, the remedy is to get another torch.—*Autogenous Welding.*

WHEELER PROTECTIVE WEARING APPAREL

Wheeler Protection Pays

The use of Wheeler Protective Apparel means efficiency, economy and absolute protection to plant and man. Every item in the Wheeler line—ranging from helmets to spats in leather, asbestos and fireproofed duck—is of the very highest grade of material and of the most modern design. Each garment fully guaranteed.

Special discounts in quantity lots. Write for details.

F. W. Wheeler Manufacturing Co.
215 West Huron Street Chicago

WELDOX

Asbestos Welding Paper

Send for a Free Sample

IT'S especially made for you—for the welder, not for the casting. Not the ordinary paper manufactured for many uses, but a scientifically prepared, long-fibre, pure asbestos paper developed for one purpose—to furnish a welding paper capable of withstanding hard usage and high temperatures without giving off noxious and injurious smoke, gases and fumes. Your men naturally can do better work when WELDOX Asbestos Welding Paper is used on every welding job.

WELDOX Asbestos Welding Paper comes in 50 lb. and 100 lb. rolls, 36 inches wide.

Test the Free Sample with a torch. Subject it to physical tests. "WELDOX" in your shop and available for every job will save in many ways: It lasts longer; it cuts out eye and lung sore for the welders; it therefore aids in turning out better work in less time.

All rolls specially wrapped, and labeled "Weldox"

Asbestos Mittens, plain or one finger and thumb.
Asbestos Mittens, 23-inch length over all.
Asbestos Gloves, 5 fingers.
Asbestos Leggings, 16-in. to 30-in. lengths.
Asbestos Aprons, made to specifications.
Asbestos Masks.
Asbestos Fibres.
Asbestos Cloth.

If it's Asbestos, we have it.

F. D. Farnam & Co.
140 South Dearborn Street, Chicago, Ill.

ELECTROLYTIC OXYGEN-HYDROGEN GENERATORS

Gas Efficiency

The most expert chauffeur can not run your car right with impure gasoline. The highest-skilled operators in cutting and welding can not turn out good work with oxygen and hydrogen of inferior grade. A 2% impurity in your oxygen cuts down the efficiency of your workmen 25% to 45%.

I. O. C. electrolytic gas generators installed in your plant assure you a steady supply of oxygen and hydrogen at top-notch purity. **I. O. C.** gases will keep your highly-paid labor from going to waste.

Write us for particulars.

"The cell with three times the capacity"

"Largest Manufacturers of Standard Electrolytic Oxygen and Hydrogen Apparatus"

International Oxygen Company

Newark, New Jersey

Verona, Pa. College Point, N. Y.
Chicago Pittsburgh Paris
I.O.C. Ltd., 38 Victoria St., Westminster, London, S.W.

ALUMINUM SOLDER

ALLWELD

This is not intended to entirely replace aluminum welding, but a real aluminum solder is a most desirable asset in the welding shops. All detrimental characteristics of so called Aluminum Solder are eliminated. Write for sample.

ALLOY WELDING PRODUCTS CO.
80 Church Street, N. Y.

OXYGEN, ACETYLENE and HYDROGEN REGULATORS

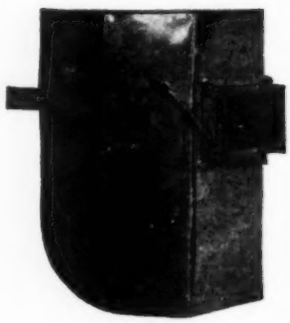
(With or without U. S. Gauges)

Approved by Board of Fire Underwriters

UNIVERSAL REGULATOR COMPANY
775-9 Communipaw Ave., JERSEY CITY, N. J.

Single And Multiple Constant Current Arc Welders.

The Type "F" Aluminum Face Shield weighs but 1 lb., 11 oz.



National Electric & Welding Co.
Main Office
111 W. 40th St., New York

"Morey" Aluminum Flux

+ + +

Your attention we kindly would ask,
Which will not be much of a task,
Our product please thoroughly try.
And a customer always--we feel you'll reply.

+ +

Morey Flux and Chemical Company
Parkesburg, Chester County, Penn., U. S. A.

WELDING RODS

High Silicon Cast Iron

ATLAS QUALITY
Swedish Welding Wire

Special Prices to Jobbers
Inquiries Solicited

ATLAS FOUNDRY COMPANY
Irvington, New Jersey

CARBON PRODUCTS FOR WELDING

Carbon Electrodes
Carbon Rods and Plates
Carbon Paste

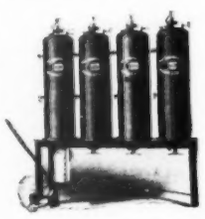
If it's carbon—we make it

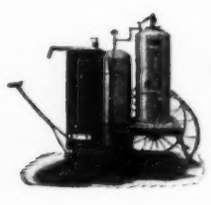
NATIONAL CARBON CO., Inc.
Cleveland, Ohio

BOOKS ON WELDING

Write for list of books on welding.
If it's in print we have it.

THE WELDING ENGINEER
60 S. Dearborn St. CHICAGO, ILL.





Bermo Welding Plants

OXY-ACETYLENE

13 years successful record

Guaranteed. Write for Catalog and Easy Terms

$25 to $250

Bermo Supply Co., Omaha, Neb.

The Oxy-Thermalene Method of Welding, Cutting, Brazing, Etc.

ACETYLENE OIL GAS PRODUCER the gas of greatest efficiency, economy and SAFETY. The only class of its kind Saves 25% on gas and oxygen.

FIRST CLASS REFERENCES
Special Welding MACHINES, guaranteed no flash back cutting and welding torches, and supplies.

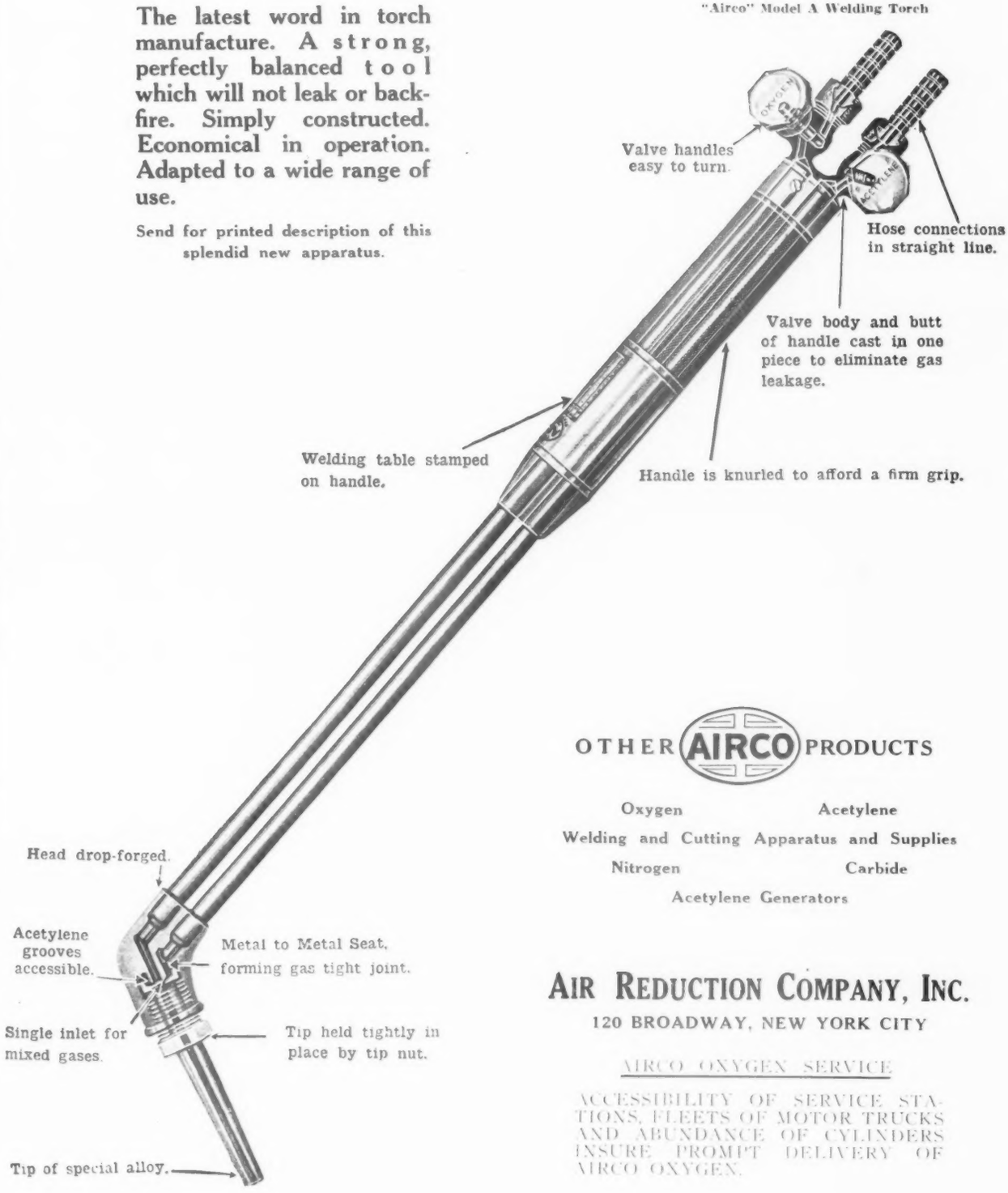
The Thermalene Co., Chicago Heights Ill.

THE NEW AIRCO WELDING TORCH

The latest word in torch manufacture. A strong, perfectly balanced tool which will not leak or back-fire. Simply constructed. Economical in operation. Adapted to a wide range of use.

Send for printed description of this splendid new apparatus.

"Airco" Model A Welding Torch


Valve handles easy to turn.
Hose connections in straight line.
Valve body and butt of handle cast in one piece to eliminate gas leakage.
Welding table stamped on handle.
Handle is knurled to afford a firm grip.
Head drop-forged.
Acetylene grooves accessible.
Metal to Metal Seat, forming gas tight joint.
Single inlet for mixed gases.
Tip held tightly in place by tip nut.
Tip of special alloy.

OTHER AIRCO PRODUCTS

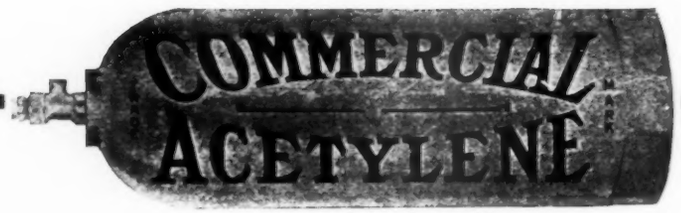
Oxygen — Acetylene
Welding and Cutting Apparatus and Supplies
Nitrogen — Carbide
Acetylene Generators

AIR REDUCTION COMPANY, INC.

120 BROADWAY, NEW YORK CITY

AIRCO OXYGEN SERVICE

ACCESSIBILITY OF SERVICE STATIONS, FLEETS OF MOTOR TRUCKS AND ABUNDANCE OF CYLINDERS INSURE PROMPT DELIVERY OF AIRCO OXYGEN.



The better the acetylene, the speedier, smoother and more uniform the welding process. **Commercial Acetylene,** with a uniform purity of 99%, is always dependable. To perfect its quality, it passes through a dozen different apparatuses in manufacture. A tribute to this quality is the general use of Commercial Acetylene by the United States government for harbor lights in all our great harbors. For these lights, which must never fail, only acetylene of highest purity and uniformity will serve.

Commercial Acetylene is available in portable cylinders of several sizes. **No charge for cylinders.**

Write for information.

Commercial Acetylene Supply Co.

Main Office **80 Broadway,** **New York City**

208 S. La Salle Street, Chicago

Atlanta, Ga. **Aurora, Ill.** **Boston, Mass.** **Bound Brook, N. J.**
East Deerfield, Mass. **Toronto, Ont.** **San Francisco, Calif.**
Moberly, Mo. **W. Berkeley, Calif.**